ALSO IN OUR NEWS SECTION: U.S. IT workers in an H-1B huff should face reality and change roles, panelists say. PAGE 6
HP axes 1,800 more jobs, but users laud its postmerger integration effort. PAGE 10

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SEPTEMBER 30, 2002 • VOL. 36 • NO. 40 • $5 COPY

LARRY GOODE

REPORTING on a REVOLUTION

From the early IT professionals who worked in basement offices to today's high-powered CIOs who command multimillion-dollar budgets, the world of IT has seen big changes over the past three decades. In our special 35th Anniversary issue, *Computerworld* recounts technology's journey, from its beginnings as a promising contributor, to the central role it plays in the economy and corporate strategies today. We also chronicle the evolution of the IT leader.

STORIES BEGIN ON PAGE 21.

HIGHLIGHTS OF OUR 35TH ANNIVERSARY EDITION:

- **The 35 technologies** that have changed the game for corporate IT.
- **From the back office** to the boardroom: the changing role of the IT leader.
- **Three pioneering projects** that altered the technology landscape forever.
- **Three bleeding-edge industries** whose fierce competition sparked IT innovation.
- **From 1967 to 2002,** a timeline of technology events and inventions.
- **PLUS: Predictions on the future of technology and IT** from Gordon Moore, Steve Ballmer, Larry Ellison and many other industry luminaries.

CELEBRATING 1967 35 YEARS 2002 IT LEADERSHIP

IBM AUTOMATES PRIVACY COMPLIANCE

New system developed with input from users

BY PATRICK THIBODEAU
WASHINGTON

IBM next month will launch a privacy management product, created with the help of some large corporate users, that lets companies build privacy policies directly into their data management systems. The aim is to enable companies to automate their compliance with privacy laws and corporate regulations.

The IBM system is unique in that it takes "privacy law and turns it into a set of privacy rules. I haven't seen anything like that in the industry," said Rick Lacafta, head of IT security at Travelers Property Casualty Corp. in Hartford, Conn. "I think it's a very big strength of the product."

But Lacafta also sees the IBM Tivoli Privacy Manager as a work in progress that has to be developed for more environments and tested for its impact on performance. Travelers, a member of IBM's end-user group, the Privacy Manager Council, is piloting the tool and starting development work to adapt it to some of its customer data systems.

Privacy System, page 81

INSIDE: States' actions may spur Congress to pass privacy legislation. PAGE 81

ONLINE: For extensive coverage of privacy issues, visit our Web site:
QuickLink s1200
www.computerworld.com

HP USER DEFECTS; EMC, IBM SCORE

High-profile site dumps its Compaq equipment

BY LUCAS MEARIAN AND TODD R. WEISS

One of the showcase users Hewlett-Packard Co. acquired when it bought Compaq Computer Corp. is completely retooling its IT infrastructure around IBM servers and EMC Corp. storage devices.

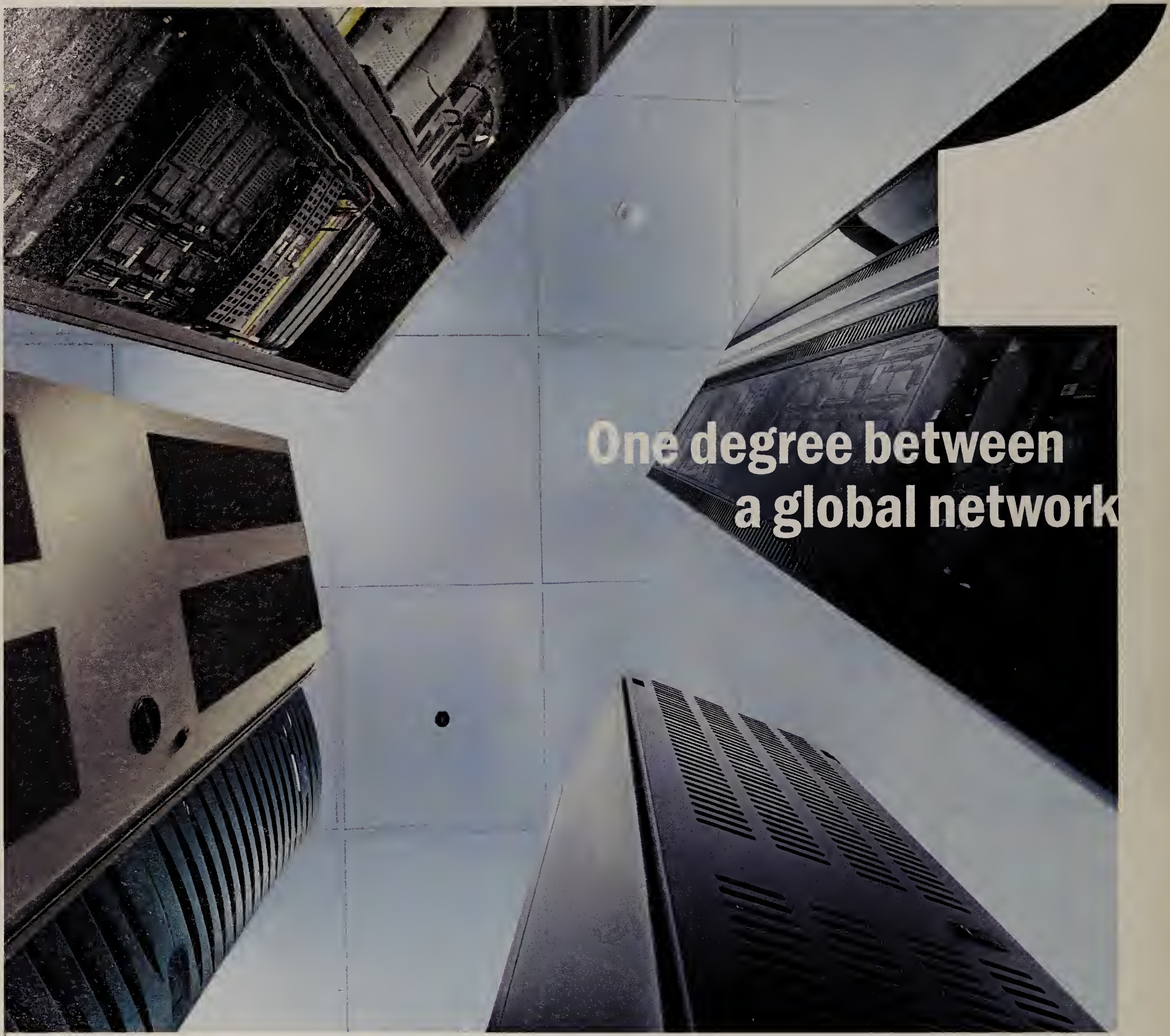
Norwalk, Conn.-based Applera Corp. last week announced that it plans to replace all of its Compaq equipment under separate deals with IBM and EMC. The contracts with Applera, a biotechnology company that successfully mapped the human genome, involve more than 150TB worth of EMC's high-end disk arrays and a dozen of IBM's 32-processor p690 Unix servers configured in a cluster.

None of the companies would disclose the value of the deals, but analysts said the total cost is likely to be in the tens of millions of dollars. Each of the p690 servers lists for about $2 million, and Applera is buying three of EMC's Symmetrix arrays, which analysts said can cost more than $1 million apiece. It's also buying two of EMC's Celerra file servers.

Mark Gonzalez, vice president of storage sales for HP's U.S. operations, said IBM and EMC undercut HP on price in order to steal away a high-

HP, EMC, page 16

NEWSPAPER



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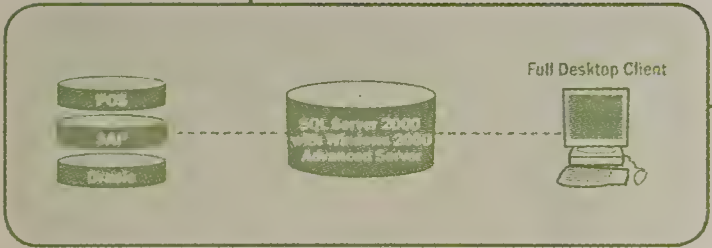

Microsoft

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SEPTEMBER 30, 2002

COMPUTERWORLD THIS WEEK

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7 Dell's commoditization strategy causes networking vendors Cisco and 3Com to end reseller agreements with the company.

7 Some Siebel CRM users are still waiting for a payoff.

12 Microsoft will release today the beta version of Systems Management Server 2003.

14 Ready or not, Web services management products are starting to emerge.

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ONLINE

IT'S AMAZIN'

Corporate computers that can live outside glass walls, desktop PCs, pocket calculators, the wireless Web . . . . Join our 35th anniversary discussion and let us know what technology has amazed you the most over the years.
QuickLink a2560

BEST OF THE REST

Our Knowledge Center editors scour the Web for useful links to add to their Editor's Choice picks and update them throughout week.
QuickLinks:

- **Development a2500**
- **Security a2520**
- **Storage a2540**
- **Wireless a2550**

BREAKING NEWS

For the latest news, updated twice daily, visit:
QuickLink a1510
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CELEBRATING 1967 35 YEARS 2002 IT LEADERSHIP

In our special 35th anniversary issue, *Computerworld* recounts technology's journey from promising contributor to the central role it plays in today's economy. **COVERAGE BEGINS ON PAGE 21**

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From dynamic RAM to the Web to PDAs, we look back over the years to find the 35 most important advances in corporate IT.

28 The Evolution of the IT Leader
Four famous CIOs examine the artifacts of the evolving IT culture and the changing role of the IT leader. Also, *Computerworld*'s founder, Patrick J. McGovern, on the early days of IT. **ONLINE:** A full-length discussion on the future of the IT leader. **QuickLink 32201**

34 35 Years of IT Follow the history of the IT industry with key dates and events throughout the years — from 1967's first issue of *Computerworld* to WorldCom's bankruptcy filing this year.

PIONEERING PROJECTS

34 Technology Takes Flight The Sabre reservation system gave e-commerce wings and helped revolutionize air travel. **ONLINE:** How much blame should go to the GDSs for not moving more quickly to update their 1960s-era technology? **QuickLink 32206**

38 A New Supply Chain Forged
By investing in cutting-edge technology, Wal-Mart changed the face of business with its inventory and supply chain management system. **ONLINE:** More sophisticated than bar codes, smart tags can track a product's location down to the inch. **QuickLink 32434**

40 The Web's Bestseller Amazon.com drew consumers to the Web in droves and forever changed inventory control. **ONLINE:** Venture capitalist Mario Morino talks with *Computerworld* about the role Amazon.com has played in the legacy of e-commerce. **QuickLink 32061**

Pictured from top: Steve Ballmer, Carly Fiorina, Scott McNealy, Sanjay Kumar, Larry Ellison and Esther Dyson

PIONEERING INDUSTRIES

46 Securing Credit Data They didn't invent any technology, but MasterCard, Visa and American Express have been power users, building fortresses of secured customer data. **ONLINE:** How Visa and MasterCard are upgrading their processing networks to meet future demand. **QuickLink 32642**

50 Signed, Sealed and Delivered
FedEx and UPS have pushed the technology envelope with their obsession with information and a fierce game of one-upmanship. **ONLINE:** How these companies are using wireless LANs to increase the efficiency of internal workers. **QuickLink 32164**

54 Banking on Technology Banks and brokerages such as Fidelity, Schwab, Citibank and Wells Fargo have used technology to connect with consumers in an increasingly cutthroat marketplace. **ONLINE:** Schwab CIO Geoff Penney talks about the early days of the Internet. **QuickLink 32264**

56 Pioneers & Visionaries
Computerworld reporters talk with the movers and shapers of the IT industry about their predictions for the future of technology. Find interviews with Gordon Moore, Steve Ballmer, Irving Wladawsky-Berger, Carly Fiorina, Sanjay Kumar, Vinton G. Cerf, Larry Ellison and many more.

74 The Best and the Worst The most costly viruses, top 10 Best Places to Work in IT and other highs and lows.

82 35 Years of Tech Flops For every technology hit, there were a few misses. Columnist Frank Hayes looks at the technologies that didn't cut it.

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MORE INDUSTRY HEADLINERS

For full interviews with the IT leaders in this issue, as well as profiles of other industry headliners, visit us online.
QuickLink a2530

THE NEXT BIG THING

Voice activation? Sense-and-respond systems? Six IT luminaries predict the next technological advance that will radically change the business landscape. **QuickLink 32202**

COMING UP ROSES

FTD planted the seeds of e-commerce with its easy-to-use Mercury network, giving florists a technology that fit their business.
QuickLink 33160

FLASH BACK IN TIME

Computerworld's popular Flashback series chronicles key events in the technology industry from the 1950s through the late 1990s.
QuickLink a2490

AT DEADLINE

Sun Readies New StorEdge Disk Arrays

Sun Microsystems Inc. will expand its StorEdge disk array line on Wednesday by announcing new models that are aimed at backing up workgroup-level Unix servers but provide enterprise-class storage capabilities. The first product, the StorEdge 3310, is due to ship in mid-October and will include features such as dual RAID controllers and disk hot-swapping support, Sun said.

Vendors to Propose Security Flaw Rules

Microsoft Corp., Oracle Corp. and nine other software vendors and IT security firms said they have completed the process of setting ground rules for jointly developing proposed standards on reporting and publicizing security vulnerabilities. The group, which is calling itself the Organization for Internet Safety, plans to release a draft set of proposals early next year.

Siemens Unit Adds Voice Network Gear

Siemens Information and Communications Networks Inc. today plans to announce a product that lets mobile workers use a single telephone, phone number and voice mail message box for corporate voice communications. The Boca Raton, Fla.-based subsidiary of Siemens AG will also detail a phone-based Web portal for customer self-service uses.

Short Takes

MANUGISTICS GROUP INC., a Rockville, Md.-based vendor of supply chain software, reported a $47.7 million loss for its second quarter, which ended Aug. 31, and said it will cut up to 12% of its 1,400 workers. . . . St. Paul, Minn.-based **LAWSON SOFTWARE INC.** said it plans to lay off 12% of its more than 2,000 employees after losing $1.9 million in its first quarter, which ended Aug. 31.

Unisys Clears Path To Single Architecture

New server finishes shift of mainframes to run multiple OSes

BY JAIKUMAR VIJAYAN

With the introduction of its newest ClearPath Plus server last week, Unisys Corp. has completed migrating all of its proprietary mainframe-class servers to a single architecture based largely on Intel Corp. technologies.

The ClearPath Plus Libra Model 180 gives users of the company's high-end Enterprise Server NX6830 a way to run applications written for Unisys' proprietary MCP operating system, as well as those for Windows, Unix and Linux.

The new ClearPath system is based on Unisys' Cellular MultiProcessing (CMP) architecture, which lets users mix applications running on Wintel technology with those running on proprietary Unisys processors in a single box.

The Model 180 supports up to 40 processors and 40 partitions, and delivers up to 50% more application-level performance than the NX6830, according to Rod Sapp, a director at Blue Bell, Pa.-based Unisys.

New with the ClearPath Plus Libra is a performance distribution technology that's capable of dynamically allocating computing resources to applications as they need it.

That gives MCP users a single, centralized resource based on open technologies for managing diverse computing resources, Sapp said. And it lets users protect their investments in their legacy systems.

"This fulfills the Unisys commitment to transition all of our mainframe server offerings to the CMP architecture," Sapp said. "The only place we had not done it until now was the high-end MCP environment."

Community First Bankshares in Fargo, N.D., has purchased one of the servers because of its partitioning abilities, its I/O performance and its support for multiple operating systems, said CIO Dan Fisher.

The financial services company plans to use the server to run its core MCP-based banking applications, as well as to host new Windows-based applications, Fisher said. The server's partitioning capabilities will also let the bank run development, test and production applications in the same server, he added. "We're highly appreciative of the box. We've been waiting for it for some time," Fisher said.

But the systems and workload management software required to manage the multiple operating environments supported by these servers needs to mature before users can take full advantage, said Robert Schafer, an analyst at Meta Group Inc. in Stamford, Conn.

The ClearPath Plus Libra servers are available immediately and range in performance from a box capable of 40 MIPS and costing $954,000 to a maxxed-out 2,100-MIPS system that can cost $17 million. ◗

Migration Path

The Unisys ClearPath Plus Libra Model 180 supports:

CAPACITY ON DEMAND: Administrators can add processing capacity and scale it back depending on the workload.

WORKLOAD PRICING: Unisys provides substantial discounts for use of ClearPath Plus partitions devoted to application development as well as production work based on selected 4GL development tools.

Panel Advises U.S. IT Pros To Consider Changing Roles

BY THOMAS HOFFMAN
NEW YORK

Unemployed U.S. IT professionals who are grumbling about lower-cost H-1B workers and offshore outsourcing firms wresting their jobs away should accept the market reality that highly skilled, cheap foreign labor is here to stay. They should also broaden their own talents beyond programming acumen. That was the assessment of panelists who spoke at Brainstorm Group Inc.'s Nearshore and Offshore Outsourcing conference here last week.

"There's certainly a feeling out there that [offshore programming is] a threat to American IT workers," said Larry Gordon, vice president of marketing at Cognizant Technology Solutions Corp., a Teaneck, N.J.-based custom software developer with offshore programming interests in India. Gordon participated in a global sourcing panel discussion that was moderated by *Computerworld*.

"Programming is becoming commoditized. If you can do programming for $20, $25 an hour, why would you pay $150 an hour?" asked Amit Govil, managing director and CEO at Sapient India in New Delhi.

Act as a Bridge

The growing unemployment of U.S. technologists "is a very serious problem," said Kent Bauer, principal consultant at GRT Corp., a Stamford, Conn.-based data management consultancy with operations in Russia. He suggested that U.S. IT workers consider "moving up the food chain" by working more closely with business units to help steer big projects like enterprise resource planning and customer relationship management initiatives.

Govil suggested that U.S. technologists act as a bridge between IT and the business units they serve "by becoming planners and organizers" in charge of implementing "conceptual solutions."

Srinivas Raghavan, a liaison at American International Group Inc. for Troy, Mich.-based outsourcer Syntel Inc., said he believes there are "huge opportunities" for U.S. IT workers to bundle their expertise in communications and integration skills. For example, a growing number of companies are focusing on further integrating e-business systems and other types of applications throughout their organizations. ◗

Stayin' Alive

Here are some tips from offshore outsourcing providers to U.S. IT workers on how to protect their careers:

SEEK to establish a position in IT as a **technology liaison** to a business unit.

BECOME a planner or an organizer of **conceptual projects** within an IT organization.

LEVERAGE existing communications and technical skills to **help integrate e-business** and other business process applications throughout an organization.

Correction

The company that employs analyst Charles Kolodgy was misidentified in the story "Wanted: A Clear View of Vulnerability" in the Technology section of our Sept. 9 issue. Kolodgy works at Framingham, Mass.-based IDC.

Dell's Commodization Plan Prompts Cisco, 3Com to Bail

Networking vendors drop Dell as reseller; Lexmark signs on following HP's pullout

BY BOB BREWIN

Although three major equipment vendors have recently terminated reseller agreements with Dell Computer Corp., there are no indications that other suppliers will drop out anytime soon.

On the heels of Cisco Systems Inc.'s announcement two weeks ago that it would end its networking equipment reseller relationship with Dell as of Sept. 27, 3Com Corp. last week pulled the plug as well. Those moves followed Hewlett-Packard Co.'s decision in July to drop Dell as a printer reseller. Chiefly at issue is Dell's strategy of commoditizing products in those vendors' spaces.

But while suppliers in general may not like that strategy, many have little choice in what is a less than robust technology market, said Alan Promisel, an analyst at IDC in Framingham, Mass. "Suppliers need Dell to drive their shipments," he said.

Rob Enderle, an analyst at Giga Information Group Inc. in Cambridge, Mass., said he agreed that suppliers will think twice before dropping Dell, "because it's hard to find someone else to pick up the slack." But, Enderle added, as Dell starts to push its own branded products in competition with its suppliers, "more may bail out."

3Com 'Won't Legitimize' Push

When Santa Clara, Calif.-based 3Com dropped its reseller agreement with Dell last week, it cited the company's aggressive push of Dell-branded networking products. "Dell has made it clear that it aspires to gain market share in networking, and 3Com won't help Dell legitimize its sales offering with 3Com's products or 3Com's channel program benefits," said 3Com spokeswoman Catriona Parker.

Bruce Shaw, Dell's senior manager for networking products, said that despite Parker's sweeping statement, Dell still does business with 3Com, reselling low-end products such as network interface cards and modems. But Dell's line of PowerConnect network switches is "doing very well," Shaw said, adding that the company intends to expand its networking product line.

Although Cisco's reseller agreement ended Friday, it will allow Dell to continue ordering products through the end of next month, according to Cisco spokesman Lang Tibbils. He declined to say why Cisco severed the relationship but dismissed Dell as a significant customer. Cisco has 10,000 authorized resellers, Tibbils said, "and I would not classify Dell as big in terms of the amount of Cisco equipment sold."

Shaw said he spent last week discussing the 3Com and Cisco moves with other key networking suppliers, such as Enterasys Inc. in Portsmouth, N.H., Extreme Networks Inc. in Santa Clara, Calif., and Nortel Networks Ltd. in Brampton, Ontario. He said the 3Com and Cisco decisions "did not seem to have an effect one way or the other" on the three suppliers.

When HP ended its Dell reseller agreement — which covered printers, personal digital assistants and cameras — it expected Dell to soon enter the printer and toner cartridge business. Dell did just that last week, announcing an agreement with Lexmark Inc. in Lexington, Ky., under which Lexmark will be its preferred printer supplier and will ultimately manufacture Dell-branded printers.

IDC's Promisel said the printer deal is designed to put pressure on HP's high-margin printer business. "Dell is going to start slicing and dicing margins to force HP to play the same game," Promisel said.

Dell founder and CEO Michael Dell told *Computerworld* in an interview last month [QuickLink 32314], "I have a fundamental belief that all technologies over time commoditize." That includes the storage space, where Dell has a reseller agreement with EMC Corp. in Hopkinton, Mass. Dell so far has concentrated its branded storage products at the low end, leaving the high end to EMC. "The relationship is going very well," said EMC spokesman Rick Lacroix. ◗

Joris Evers of the IDG News Service and Computerworld's *Lucas Mearian contributed to this article.*

Dell Reseller Scoreboard

NETWORKING
Out: 3Com, Cisco
In: Enterasys, Extreme Networks, Nortel

PRINTERS AND CARTRIDGES
Out: HP
In: Lexmark

STORAGE
In: EMC (high end only; Dell is going after the low end)

Survey Suggests That Siebel Users Face Uncertain ROI

BY MARC L. SONGINI

Illustrating the potential complexity of customer relationship management (CRM) projects, survey results released last week indicate that many users of Siebel Systems Inc.'s market-leading software are having trouble getting a return on their multimillion-dollar investments.

Nucleus Research Inc., a consulting firm in Wellesley, Mass., that focuses on IT return on investment, said 14 of the 23 Siebel users it surveyed had yet to achieve a payback after more than two years of working with the company's CRM applications at an average project cost of about $6.6 million.

Nucleus said the users cited issues such as the difficulty of training employees to use the software, application customization problems and implementations that went over budget and took longer than expected (see box).

Steve Mankoff, senior vice president of technical services at San Mateo, Calif.-based Siebel, claimed that the survey wasn't statistically valid. According to Siebel's own quarterly surveys, 12 months is the median point for its customers to get ROI, he said.

"By no means are we perfect, but we always work with the customer," Mankoff said. "If we have customers who are unhappy or who have problems, we try to fix it."

SURVEY

CRM Pitfalls

Of the 23 Siebel users surveyed by Nucleus Research:

- **18 SAID** the software wasn't user-friendly enough
- **15 REPORTED** that they had software customization problems
- **12 SAID** their deployments took longer than planned *
- **11 SAID** their projects cost more than they had budgeted **

* Only 21 users responded
** Only 20 users responded

But Jay Gardner, CIO at Houston-based BMC Software Inc., said the survey results are consistent with his Siebel experience. Citing challenges such as lukewarm end-user adoption and a lack of management commitment, Gardner said it took three tries before BMC got Siebel's sales force automation software up and running.

BMC started its Siebel project in 1995 but didn't complete the rollout until early 2000, Gardner said. "We certainly would have been in that category of suffering from a lack of satisfaction," he added.

Rebecca Wettemann, a Nucleus analyst, said the names of the surveyed companies were taken from Siebel's Web site. "It's pretty astonishing that these are Siebel reference customers and they are not getting a return on investment," she said.

But the results aren't a surprise, said Erin Kinikin, an analyst at Giga Information Group Inc. in Cambridge, Mass. "The Siebel sales force automation product is one of the hardest applications to implement ever," she said. And the difficulties aren't limited to Siebel's applications Kinikin added; CRM software as a whole is still in its infancy, she said.

Tim Arnold, IT manager at Bose Corp., said the Framingham, Mass.-based maker of audio systems is on track to hit ROI projections for its Siebel installation. Bose went live with Siebel's sales force software two years ago and added more applications last fall. The company has already reaped many of the anticipated benefits, such as reduced software maintenance costs, Arnold said.

Some of the problems cited by Nucleus may have had more to do with internal project management issues at the surveyed companies than with Siebel's software, said John Boushy, CIO at Harrah's Entertainment Inc. in Las Vegas.

But the cost of Siebel's applications has been an obstacle for Harrah's, Boushy said. The casino operator has spent $75 million to buy, install and operate various CRM systems. But it has shied away from Siebel's software, Boushy said. ◗

CRM PROJECT TIPS

Some Siebel users say good project management is a must:

QuickLink 33202
www.computerworld.com

BRIEFS

Deutsche Bank, IBM Sign Outsourcing Deal

Frankfurt-based Deutsche Bank AG plans to hand over its European IT operations to IBM as part of an outsourcing deal that's due to take effect in the first quarter of next year. IBM said it will also use the bank's systems to provide IT services to other users in Europe. The companies didn't disclose the value of the deal, which will affect about 900 Deutsche Bank IT workers.

Microsoft Warns of FrontPage Code Flaw

Microsoft Corp. said a security hole in its FrontPage Server Extensions software could be used to run malicious code or carry out denial-of-service attacks on vulnerable Web servers. Microsoft gave the flaw its highest severity rating and urged users to install a patch for the software, which can be used to manage Web sites built with the company's FrontPage development tools.

J.D. Edwards Ships Middleware Upgrade

J.D. Edwards & Co. released an upgrade of its middleware for integrating systems at different companies that use the Denver-based vendor's business applications. The upgraded software includes full native support for Web services and a dozen new predefined business processes that can be used to automate data workflows, J.D. Edwards said.

Short Takes

Hopkinton, Mass.-based **EMC CORP.** said it agreed to buy Prisa Networks Inc., a San Diego-based developer of storage-area network management software, for about $20 million in cash. . . . The European Commission approved **IBM**'s planned $3.5 billion purchase of **PWC CONSULTING**, the IT services and consulting unit of New York-based PricewaterhouseCoopers.

MARK HALL ▪ ON THE MARK

Intel Taps Linux Developer for IA-64 . . .

. . . software partitioning capabilities that the microprocessor giant needs for its high-performance chips to compete against powerful Unix-based RISC systems. SWsoft Inc. in San Francisco has inked a deal with Intel Corp. to develop a version of its Virtuozzo partitioning technology for IA-64 processors. The agreement, which will be announced in mid-October, calls for SWsoft to deliver multiprocessor partitioning software in the first half of 2003. Last week, the company demonstrated Virtuozzo 2.5, its current release, running **2,500 instances of Red Hat Linux** on an eight-processor Dell server, something that clearly **impressed the chipheads at Intel.** ▪ The livelihood of search engine giants depends on selling keywords to retailers and e-commerce sites that crave Web traffic in bulk. "It's a $1 billion industry," claims Steve O'Brien — an industry that currently bills keyword buyers on "cost per click." That may change in the coming months. O'Brien's the vice president of marketing at Los Altos, Calif.-based Fireclick Inc., which is, along with other vendors of analytic tools, readying software to potentially change the pricing model to "cost per dollar," giving users an advantage in the **keyword bidding war**. In the fourth quarter, Fireclick's hosted analytic service, Netflame, will add a feature — now in beta — that measures the dollar value of keyword visitors delivered by the search engine companies. ▪ Most network users once flocked to popular brand names for their managed IP infrastructure. That was before **the mess at WorldCom Inc.** Since then, buyers of IP capacity have been looking more carefully at a provider's balance sheet than, say, its Super Bowl ads, says Bob McCormick, CEO of Savvis Communications Corp. Although not profitable yet, the $250 million Herndon, Va.-based networking company has raised $178 million in preferred equities since March, giving it deep pockets at a time when others are in deep debt. Part of that nest egg will go into upgrading by year's end Savvis' network security to the latest version of IPsec. ▪ **Notoriously insecure instant messaging systems** from the likes of Microsoft Corp., America Online Inc. and Yahoo Inc. have a friend in Omnipod Inc. in New York. The 3.0 version of the company's eponymous server-based software, which will ship next month, can keep corporate networks secure even if users, such as help desk staff, need to work with outsiders who use public IM clients. The upgrade improves on Omnipod's client user interface and makes it simple to import contact information, such as AOL's "buddy list," from the major IM clients. It also adds administrative features that let IT managers classify users and assign access rights and group-to-group communications. ▪ The beauty of supply chain automation tools is that they can sound alarms about manufacturing and distribution glitches. And now they're beginning to show users ways around the problems. Later this week, Valdero Corp. in Palo Alto, Calif., will release its **Supply Chain Control 2.0 software** with the ability to recommend, for example, which orders to complete during a parts shortage, based on business rules defined by users. ▪ With the constant stream of software upgrades, it's appropriate that late next month, Euclid Inc. in San Jose is releasing the 2.5 version of its Trinity Services Management Suite, currently on Release 2.0. The upgrade will sport new change management features that can trace an application's interdependencies on other systems within a distributed environment, making a **change to IT operations less treacherous**, as it should be. ◗

Upgrade City

Resonate Inc.'s Commander 2.1 update goes gold this week with new ways to test and improve performance of FTP, DNS and other services.

••••••••••••••••••••

Software for **Stratum8 Networks Inc.'s** Web server security appliance hits Version 1.6 this week, improving encryption and GUI features.

Nortel Puts Focus on Network Security

Vendor also cuts Q3 forecast for second time since August

BY MATT HAMBLEN

As part of its effort to stop a continuing revenue slide, Nortel Networks Ltd. last week launched two IT infrastructure security products that are part of a wider network security architecture detailed by the company.

But the security technology announcement was followed by another reduction in Nortel's anticipated revenue for the third quarter — its second forecast cutback since late August. Brampton, Ontario-based Nortel said it now expects third-quarter business to be about 15% less than the $2.77 billion it reported for this year's second quarter.

Technology Push

Zeus Kerravala, an analyst at The Yankee Group in Boston, said Nortel's precarious financial condition requires it to put a renewed emphasis on technology innovation over networking services aimed at voice and data carriers.

As part of what Nortel is calling its Unified Security Architecture, the company introduced an extranet management appliance that supports Secure Sockets Layer (SSL) and upgraded a line of IP services gateway devices so they can handle wireless LANs and voice over IP applications.

"They obviously bolstered their product line with this announcement, making a statement that they are a legitimate technology company to pull away from their service provider focus," Kerravala said. He noted that the Alteon SSL 410 appliance for SSL extranets is the first application-layer accelerator and content-filtering product for virtual private networks (VPN) to be offered by a large networking vendor instead of by a start-up.

The secure IP gateway, called Contivity, is already the most popular product of its kind with managers of large networks, according to Kerravala and Mark Bouchard, an analyst at Meta Group Inc. in Stamford, Conn. Now Nortel is adding secure routing technology that supports dynamic rerouting of data over a secure VPN link.

Pricing for the Alteon SSL 410 appliance starts at $24,995, and an enterprise-class Contivity gateway costs $7,300. Both are available now, Nortel said. ◗

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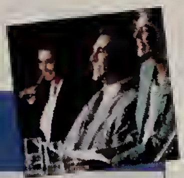

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HP's Integration Effort Gets Favorable Reviews

Users also support broad technology strategy

BY JAIKUMAR VIJAYAN
LOS ANGELES

HEWLETT-PACKARD Co. executives who used last week's HPWorld 2002 trade show here to talk up the company's new stem-to-stern technology capabilities got a thumbs up from users on its postmerger integration efforts.

HPWORLD

In HP's first major user show since its acquisition of Compaq Computer Corp., company officials pounded home a strategy that combines internal technology strengths with those of business partners to deliver a full complement of integrated products and services.

On the hardware front, HP will take advantage of technologies such as its HP-UX version of Unix and Compaq's strengths in clustering, fault-tolerant computing and corporate Windows installations to deliver a desktop-to-high-end server portfolio, said HP CEO Carly Fiorina in a keynote address.

On the software side, the focus will be on helping companies better manage heterogeneous environments and on making it easier to integrate disparate systems data and next-generation Web services, Fiorina said. To that end, HP will continue to invest in building up the management capabilities of OpenView to embrace Web services.

HP will depend heavily on partnerships in the process. Last week's $50 million agreement with Microsoft Corp. to jointly develop .Net-based Web services applications (see story below) and a deal under which HP will integrate BEA Systems Inc.'s WebLogic application server software into HP-UX are examples, Fiorina said.

In the same vein, HP will team with major systems integrators such as Electronic Data Systems Corp. to deliver services in specific application areas and industries, said Debbie Dunnam, a vice president with HP Services. HP will also tap the resources of its vast value-added reseller network to deliver and support the technologies, she said.

"The goal is not to own the solution stack but to help customers better manage it," Dunnam said.

So far at least, HP's strategy and integration efforts appear to be getting a positive reaction from users. "I'm actually surprised that the merger has worked so well," said Wayne Clesi, a systems administrator at Mayer Electric Supply Co. Inc. in Birmingham, Ala. Most of his early concerns regarding product and business disruption following the merger have been largely misplaced, Clesi said. "I'm impressed with the way it's been handled," he said.

"I like the direction the company is headed in," said Andy Eades, a senior systems administrator at American Water Heater Co. in Johnson City, Tenn. The multivendor services capability HP has acquired through Compaq is particularly useful, he noted.

"We had a vocal few in the beginning that weren't very supportive of the merger," said Linda Roach, a board member of Interex, the Sunnyvale, Calif.-based HP user group that arranged last week's show. "But they seem to have quieted down."

HP is going to need the support. Like other major IT vendors, it has been hurt by the economic slowdown. The company racked up over $2 billion in losses in its first postmerger quarter — mainly from merger-related expenses. Despite being propelled to a market-leading position in several segments, HP saw declines in revenue in key businesses, including high-end systems and storage. It has blamed the declines on slow IT spending, but analysts have said the company's problems are also related to a specific weakening of demand for its server and storage products.

In a mid-September report filed with the U.S. Securities and Exchange Commission, HP indicated that by end 2003, it will lay off an additional 1,800 employees on top of the 15,000 it had previously announced. In a statement on Friday, HP attributed the move to a "longer than previously estimated" slowdown in corporate IT spending.

Laurie McCabe, an analyst at Summit Strategies Inc. in Boston, said the additional layoffs shouldn't be taken as a sign of any specific merger-related problems at HP. ◗

HP's World

Highlights of HP's technology focus:

- Systems based on **Intel Itanium and IA-32 processors** that support multiple operating systems, including HP-UX, Linux and Windows.
- Support for **.Net and J2EE-based** Web services applications.
- Management software, led by **OpenView,** that enables the real-time management of multiple operating environments and system resources.

ADAPTIVE INFRASTRUCTURE

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Microsoft, HP Invest $50M to Promote .Net

Longtime partners Microsoft Corp. and Hewlett-Packard Co. last week announced a $50 million investment to promote, sell and help users build systems that rely on Microsoft's .Net development framework.

By the end of 2004, more than 5,000 HP sales personnel will be trained on .Net technologies, the companies said. In addition, 3,000 HP Services professionals will be certified to work on .Net systems and a new 180-person team of "solution architects" will be formed to sell .Net-based systems that aim to address business needs such as enterprise integration, collaboration, business analytics and intranet portals.

The $50 million investment, which is being split equally between HP and Microsoft, will be spent primarily on training and marketing related to .Net, according to officials at both companies (see box).

In addition to training its sales and services force, HP plans to add about 1,800 consultants to its .Net practice, according to David Stubbs, global program manager for the .Net initiative at HP. The .Net-focused group, which will have 3,000 employees by the end of 2004, will also include 1,200 employees from HP's current workforce, he said.

HP's Enterprise Microsoft Services Consulting practice, which also features an infrastructure subspecialty, now employs about 3,500 people. That figure will grow to slightly more than 5,000 as a result of the new initiative, Stubbs said.

Stubbs said HP is keen to have expertise in both .Net and Java 2 Enterprise Edition technologies for building Web services. "Based upon what we've seen so far, the vast majority of large companies will have both software infrastructures in their organizations," he said.

On the flip side, Microsoft recognizes the importance of building "evidence around .Net," said Bill Brammer, director of the HP alliance at Microsoft. Brammer said the new initiative will further Microsoft's goal of enabling business partners to help customers, since Microsoft has no intention of being a big services player.

Rob Enderle, an analyst at Cambridge, Mass.-based Giga Information Group Inc., said HP's commitment "really does tell everybody that .Net is real."

"The end result is likely to benefit Microsoft more than HP if it gets other [services] players to make heavy commitments to .Net," Enderle said. "Microsoft depends on partner channels to roll out technology. If people don't step up, Microsoft doesn't sell much."

Thomas Bittman, an analyst at Gartner Inc. in Stamford, Conn., said the initiative will also work to HP's benefit because HP "needs to be seen as a strong partner with Microsoft" to differentiate itself from IBM and Dell Computer Corp.

"Dell is a box seller, and it's very efficient, and if HP only competes with Dell on being a better box seller, [HP is] going to lose," Bittman said. "In the competition with Dell, HP needs to position itself as a services and solutions player."

Compared with IBM, HP needs to be seen as the better Microsoft partner, Bittman said. "IBM is definitely going to promote the Java concept in WebSphere over .Net," he said.

Michele Cantara, an analyst at Gartner's Dataquest division in San Jose, said HP's "ultimate target is not necessarily to be the next IBM, just to maximize their own revenues and profits. I don't think they need to be another IBM to succeed."

– Carol Sliwa

The $50M Question

Through December 2004, HP and Microsoft will spend $50 million to:

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Microsoft SMS 2003 Beta Gets User Nod

Early adopter Marathon Oil hopes for reduced network traffic, support costs

BY CAROL SLIWA

MICROSOFT CORP. today will release a beta version of its Systems Management Server 2003 software, providing the enhanced support that corporate IT departments have been seeking for mobile clients.

Users are anxious to get their hands on the new version because the aging SMS 2.0, which shipped four years ago, didn't work well when distributing software to PC and laptop users on dial-up connections [QuickLink 29497].

"It generates a lot of network traffic, and it isn't network-aware," said Michael Niehaus, an IT consultant at Marathon Oil Corp. in Houston.

Niehaus said he hopes SMS 2003, which Marathon Oil has been beta-testing, will "generate a fraction of the network traffic that the old SMS client did" and pay for itself "just based on support costs — not having to figure out what happened to this or that PC when it disconnected in the middle of a software install."

Better Bandwidth Use

Binary Intelligent Transfer Service (BITS), a new SMS 2003 feature based on Microsoft's Windows Update technology, will allow software to be downloaded during lull periods, when users aren't expending their bandwidth to check e-mail or surf the Internet, Niehaus said.

If the client gets disconnected, SMS will pick up the download where it left off as soon as the user is able to reconnect.

"It might take two weeks to download a package to the machine, but eventually it will get there," Niehaus noted. "With SMS 2.0, getting updates to the not-well-connected machines can be a challenge. What are you going to do? Tell someone, 'Dial in and don't disconnect for six hours' ?"

But Microsoft's BITS feature will work only on machines running Windows XP or Windows 2000, and the 6.5MB SMS client piece must be distributed to them. Niehaus said his company will use Active Directory features to run a machine start-up script that will install the SMS 2003 client.

NEW FEATURES

Systems Management Server 2003

- Improved support for mobile clients
- Tight Windows 2000/Active Directory integration
- Enhanced software asset tracking

"There will be a little bit of initial pain to get the client pushed out, but we can live with that," he said.

Niehaus said his company, which has 11,000 PCs and laptops, distributes software packages that range in size from 30KB to 800MB. He estimated that 500 to 1,000 of the machines use dial-up or virtual private network connections, noting that a 6.5MB download via a 28.8K bit/sec. modem can take 30 to 60 minutes.

He said he doesn't anticipate his company will reduce that download time. But Niehaus hopes architecture improvements will help Marathon Oil cut down the initial two-hour processing time when a user requests software via a Web page, tells SMS to deliver the software and the software requests flows, from server to server, through the SMS hierarchy.

Other new features in the SMS 2003 version include tight integration with Microsoft's Windows 2000 operating system and Active Directory (although Active Directory usage isn't required), and improvements to the product's software asset tracking capabilities.

Users will gain an application inventory option, rather than mere discovery, and they'll also be able to do software metering to see which applications are actually being used.

Niehaus said if certain packages aren't being used, an employee may be asked to uninstall the software to free up the license for someone else.

The final version of SMS is due to ship in the first half of next year, according to Martin Dey, senior product manager in Microsoft's Windows management business group.

But while the initial release will address the issue of mobile client support for PC and laptop users, it won't tackle the management problems associated with handheld devices running Pocket PC software or the Windows CE or Windows XP Embedded operating systems. That capability will ship in a value pack that will follow the main product's release by about three months, Dey said.

"It's important to Microsoft to have it, because their competitors do," said Ronni Colville, an analyst at Gartner Inc. in Stamford, Conn. But she said she doesn't think users will be in any hurry to implement it.

"While wireless devices are being used, no one is doing any big management stuff on them," Colville said. ◗

Analysts Claim Peregrine Users Are Left Scrambling

Company denies customer concern

BY TODD R. WEISS

As legal and financial issues continue to swirl around Peregrine Systems Inc., analysts are saying that increasingly nervous users need to reconsider their buying options.

However, the company said its current woes aren't affecting user interest in its new asset and service management software.

"We are telling established [Peregrine] clients that maybe they don't want to make major new investments but that there may be no reason to throw it out," said Kris Brittain, an analyst at Stamford, Conn.-based Gartner Inc. "The technologies, the products themselves, are solid products."

Potential customers who have been looking at Peregrine's infrastructure, service and asset management software offerings have "a tougher call," Brittain said.

Since May, the company has been faced with an ongoing investigation by the U.S. Securities and Exchange Commission, a subpoena from the U.S. Department of Justice and a legal battle against its former accounting firm, Chicago-based Arthur Andersen LLP. And last week, Peregrine filed for Chapter 11 bankruptcy protection.

The uncertainty surrounding the company has forced users to develop contingency plans. Stephen Elliot, an analyst at Hurwitz Group Inc. in Framingham, Mass., said his clients are worried.

"There's a whole lot of hesitation about what they're going to do," he said. "This is not something that's going to disappear overnight. Even if they do survive, you have to question how much will be left. And from a customer standpoint, that's not something you want to hear."

Joseph Marino, an analyst at Current Analysis Inc. in Sterling, Va., said Peregrine's situation will hurt new business.

"You can't make many positive recommendations for a company that's in bankruptcy," Marino said. "Any company in financial straits like this is automatically off the review list, which isn't to say the technology isn't good. But you don't trust your business to a company that's in trouble."

However, Peregrine said its troubles aren't affecting how customers view its products.

According to Nicole Eagan, senior vice president for global marketing at Peregrine, the company last week launched a six-nation, 12-city road show to confront the issues head-on with users. Peregrine's bankruptcy filing "doesn't impact their use of our products," said Eagan.

In a related matter last week, Peregrine sold its Remedy service management software line to Houston-based BMC Software Inc. for $350 million. Also included in the deal is up to $110 million in debtor-in-possession financing from BMC. ◗

Peregrine's Rough Times

A steady stream of bad news has hit the software company since spring:

MAY: Announces a revenue restatement of $100 million amid an SEC investigation.

AUGUST: Increases its revenue restatement to $250 million and is delisted from Nasdaq.

LAST WEEK: Files for bankruptcy and confirms a Justice Department subpoena for company documents.

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BRIEFS

Theater Chain Sets Linux Plans With IBM

Regal Entertainment Group Inc., a movie theater chain based in Knoxville, Tenn., said it's buying about 3,500 Linux point-of-sale terminals from IBM for use at its concession stands. The devices will run Red Hat Linux and will be linked to back-office servers in theaters and an IBM iSeries system in Knoxville. Regal said it's also testing Linux-based ticket kiosks.

Microsoft Aims Tools At Notes Users . . .

Microsoft Corp. released a pair of tools aimed at luring users of IBM's Lotus Notes software to switch to its Exchange Server e-mail and collaboration technology. Companies can use the new tools to take inventory of all the Notes applications that they're running and to analyze how frequently different applications are used, Microsoft said.

. . . As IBM Bundles WebSphere, Domino

IBM announced plans to let users of its upcoming Lotus Domino 6 e-mail server download its WebSphere Application Server software at no extra cost. The bundling of WebSphere is part of a plan, detailed by IBM earlier this year, to build support for Java 2 Enterprise Edition technology and Web services into Domino 6 [QuickLink 26920].

Short Takes

Stamford, Conn.-based IT consulting firm **GARTNER INC.** named Scott Fertig, 43, CIO. . . . **IBM** introduced a line of blade servers that are due in November and will provide a road map for the design of products under a development deal with **INTEL CORP.** [QuickLink 33020]. . . . **HANDSPRING INC.**, a maker of handheld devices in Mountain View, Calif., cut about 80 of its [illegible] workers.

Web Services Management Software Begins to Emerge

Actional product launch comes well before user demand materializes, analysts say

BY CAROL SLIWA

At this week's Web Services Edge West 2002 conference in San Jose, Web services management will gain some attention when Actional Corp. launches a product that aims to address a need that's expected to emerge.

The Mountain View, Calif.-based company, as well as a collection of small competitors including AmberPoint Inc. and Talking Blocks Inc., is running ahead of user demand at the moment, according to analysts who cover the space.

But they predict that a need will emerge as firms move beyond the experimentation stage to more complex Web services. They also expect the Big Four systems management vendors — BMC Software Inc., Hewlett-Packard Co., Computer Associates International Inc. and IBM's Tivoli Software division — to start making a bigger play in the Web services management market.

"This category is definitely critical to the success of Web services across the enterprise and between companies," said Jason Bloomberg, an analyst at ZapThink LLC in Waltham, Mass. "But it's true that Web services management is facing a bit of a catch-22. You need to have a lot of Web services to justify a Web services management platform."

In many ways, the experiences of Chris Casgar, a senior technical architect at NerveWire Inc. in Newton, Mass., reflect the degree of Web services activity that many observers have witnessed in corporate IT departments. Casgar said he has worked on about a half-dozen Web services projects where XML-based messages are being transported via Simple Object Access Protocol (SOAP), remote procedure calls or ebXML protocols to deliver information from one application to another.

"For most clients, it's an interesting thing to experiment with, but it's not something they want to go whole hog on," Casgar said, noting that all the projects involved applications behind corporate firewalls.

But once those Web services involve transactions that extend beyond the firewall, Casgar says he can foresee a need for management software to enable a company to get basic technical information, such as how long a service has been up and who's connecting to it.

New Needs

Functionality that users may eventually need in Web services management software includes:

- **System monitors that report when services are up or down**
- **Message tracking**
- **Brokering between services**
- **Assistance in deploying new versions of Web services without breaking old ones**
- **Help tying together large collections of Web services**

The Actional SOAPstation product being introduced today essentially brokers the connection between a Web service provider and the systems that use the service, helping to match data formats and security models, company officials said. SOAPstation also serves as a central point for controlling access to Web services and ensuring that systems don't break when a service is changed. It also has monitoring, auditing, alerting and reporting features.

"It sort of bridges the gap between integration and systems management," said Daryl Plummer, an analyst at Stamford, Conn.-based Gartner Inc.

Actional also makes a product called SOAPswitch, which helps companies turn existing applications into collections of Web services via adapters so they don't have to program changes to existing systems.

"The thing that distinguishes Actional is they have a way to engage with customers today," said John Rymer, an analyst at Cambridge, Mass.-based Giga Information Group Inc. But he added that the company is early with its SOAPstation Web services management product.

"Until we get more actual applications in place, management is something you need later, not now," he said. ◗

PROJECT ALLEGRO

IBM is planning an infrastructure for hosting Web services:

QuickLink 33237
www.computerworld.com

New WebSphere Studio Tool Adds Multilanguage Support

BY CAROL SLIWA

IBM's new WebSphere Studio Application Developer tool, released last week, adds support for the latest Java technologies and the company's open-source Eclipse development platform.

But corporate users may find the new enterprise version, which officially debuts today, more helpful.

WebSphere Studio Enterprise Developer goes beyond Java, adding support for the Cobol, PL1 and EGL programming languages. IBM was able to bring its legacy VisualAge Cobol, PL1 and Generator tools into the WebSphere fold through its Eclipse platform, which permits multiple tools to be used through a single interface, according to Bernie Spang, director of WebSphere Studio marketing.

"What this environment provides is the final stage of gluing all their software development languages under one development environment," said John Meyer, an analyst at Cambridge, Mass.-based Giga Information Group Inc. That should be good news for the developer groups at IBM-centric shops, he noted.

"From a training and familiarity perspective, everyone will work from the same [integrated development environment]. They'll just use different languages," Meyer said.

The enterprise version of WebSphere Studio also features support for the open-source Apache Struts framework, which lets developers visually model Web applications. Struts can help developers separate the client and business logic portions of applications and manage the interactions between them, Meyer said. ◗

Price Tags

- **WebSphere Studio Application Developer:**
$3,499 per user
- **WebSphere Studio Enterprise Developer:**
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*Source: FORTUNE July 2002

CA to Ship Multivendor SAN Portal With Web Interface

Users like improved remote management

BY LUCAS MEARIAN

Computer Associates International Inc. this week will ship a storage management tool that discovers devices on a storage-area network, automates backups across multivendor platforms and works from a Web portal, letting it consolidate management of remote office storage environments.

Users and analysts lauded the BrightStor Portal management software for significantly improving remote management of disparate storage systems and for its user interface. Also, they said, it helps reduce IT administrators' workloads.

James Barry, CIO at Boston Bank of Commerce, said his IT staff tends to be spread out traveling, "so we needed to be able to manage our storage backup and restore process from any point in the organization."

Barry has 19 Dell PowerEdge 1550 servers with about half a terabyte of data that he backs up directly to tape drives. He began beta-testing BrightStor Portal a month ago and said it has reduced his need for storage administrators by one full-time position.

"Even remotely, now that everything's consolidated and we have multiple systems per view, it's like having a command console," Barry said.

BrightStor Portal offers storage monitoring and utilization reporting, topology discovery, management of resources and backup automation. CA uses an XML-based interface it calls iSponsor/iGateway to integrate with storage management applications from other vendors (see box).

Michael Dortch, an analyst at Robert Frances Group Inc., said enterprise storage setups increasingly resemble Noah's ark, with "at least two of every different thing." CA's portal "can help bring significant order to such chaos," he said. ◗

All-in-One Storage

CA's BrightStor Portal software:

Includes a Web browser interface that provides real-time access to networked storage resources regardless of platform, vendor or operating system.

Integrates with storage management software from Network Appliance Inc., StoreAge Networking Technologies Ltd., Fort Hill Systems Inc. and LXI Corp., as well as CA's own tools.

Starts at $35,000, which includes a license for up to 50 concurrent users.

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EMC Scales Back File-Level Storage Costs

Combining Celerra engine with Clariion arrays cuts starting price in half, it says

BY LUCAS MEARIAN

EMC CORP. last week confirmed that it has enabled the processing engine used in its Celerra network-attached file server to work on its Clariion midrange disk arrays, offering users a lower-cost method of file-level data storage.

Network Appliance Inc. in Sunnyvale, Calif., this week is expected to introduce similar capabilities in a storage array that can serve up either block- or file-level data. The key difference, according to sources, is that the Network Appliance product will have an integrated architecture and won't use a separate file server engine.

For more than a year, EMC's high-end Symmetrix arrays have been able to serve up block-level data across storage-area networks (SAN) and files through the use of the Celerra processing unit. But that combination has a starting price of $350,000. Storage systems that combine the Celerra engine and Clariion arrays start at $175,000, EMC said.

The only catch is that for the time being, a Celerra/Clariion system can just serve up files. But sources said that by year's end, the combination will be able to support block-level data across a switched Fibre Channel network. EMC declined to comment on those plans.

Weighing the Options

Case Western Reserve University CIO Lev Gonick said he considered buying a high-end disk array to handle the school's storage needs. But instead, he decided to install two of the Clariion CX600 arrays that EMC introduced last month [QuickLink 32019].

The Celerra engine is being used to turn one of the arrays into a file server that supports the Cleveland school's distributed storage, Gonick said. Together, the two arrays are part of a 5TB SAN that cost Case Western $1.2 million but has let it cut its storage administration staff from 20 full-time employees to three, he added.

Network Appliance officials didn't return multiple phone calls seeking comment prior to deadline, but the company is scheduled to make an announcement tomorrow in New York. ◗

Continued from page 1

HP, EMC

profile customer. HP essentially would have had to give away its products to keep the Applera contract, Gonzalez said.

"It really did boil down to having a conversation that says, 'Hey, do you want to give us the gear to stay here?' " Gonzalez said. "We've been there and done that and have a bunch of other [biotechnology] accounts where we continue to be successful, and we just weren't willing to give away the hardware."

"I can't relate to that comment at all. I don't know what it means," retorted Paul Fingerman, vice president for applications delivery and chief architect at Applera. Fingerman said the decision to go with IBM and EMC was "value-based," but he declined to elaborate.

Applera consists of two operating companies: Celera Genomics Group, which did the genome-mapping work, and Applied Biosystems Group, which markets online informational databases, instruments and other products. Both units will use the IBM and EMC technology to support applications in areas such as drug and genomic research (see box).

Fingerman said a full migration to the new equipment should be completed in about 12 months. "But a substantial portion of it will be in production before that," he said. Plans call for the systems to be installed at the Celera Genomics data center in Rockville, Md.

Applera isn't worried about tying together servers and disk arrays from different vendors, Fingerman added. "There's a substantial track record of EMC working with IBM, and with the p-series technology in particular," he said.

The AIX-based IBM servers will replace AlphaServer systems made by the former Compaq. On the storage side, Celera Genomics and Applied Biosystems had already built a storage-area network (SAN) based on Compaq's StorageWorks arrays to handle some of their data storage needs. But Applera now plans to use the EMC devices to run a much larger SAN infrastructure.

In addition, Applera said it will use EMC's ControlCenter suite of storage management software. The company will also get IT services and technical support from IBM Global Services as part of the deals.

Mark Lewis, who took over as EMC's chief technology officer in July after serving as vice president and general manager of Compaq's Enterprise Storage Group, declined to talk about the specifics of the deal with Applera. But he said it was "a critical win" for EMC. ◗

Heavy on the Hardware

Key details about the new hardware technology that Applera plans to install:

- **The clustered IBM p690 servers will each** include 32 1.3-GHz Power4 processors and 64GB of memory.
- **The cluster will be used to run** computations and support internal database and file server applications, as well as e-business functions related to the company's online databases of medical and biological information.
- **EMC's Symmetrix arrays will centralize** the management of data for hundreds of applications, including Oracle databases.
- **EMC's Celerra file servers will manage** file sharing and directories on Windows 2000 and Windows NT systems.

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PATRICIA KEEFE

IT *Is* the Future

AS YOU READ THROUGH this week's issue, two things should become readily apparent: how far IT, and the function of harnessing computing power, has come in a relatively short period of time; and how forward-looking much of our 35th Anniversary retrospective is. And for good reason.

PATRICIA KEEFE is editorial director at *Computerworld.* You can contact her at patricia_keefe@computerworld.com.

For three and a half decades, from its infancy into a struggling adolescence, *Computerworld* has been covering our industry from the viewpoint of the people who create, deploy and maintain the country's IT infrastructure. I've been along for the ride here for 21 years and have watched technology over that period become ever more tightly woven into the fabric of our lives. More recently, I've watched the internal debate and gnashing of teeth over the loss of IT jobs and the sometimes wholesale outsourcing of the IT function.

Although some ponder whether there is a future in IT, I think they've missed the point. While the business side wrestles — sometimes badly — with how best to manage its information systems, the corporate world has vastly increased its dependence on technology. Can there really be any doubt that IT *is* the future? How exciting is that?

It's true we're a bit in the dark right now as to the form it will take. Our op-ed columnists this week are right — the past is often not the best predictor of the future, and no matter how well considered they may seem at the time, our best efforts to peer ahead are often wrong.

But sometimes they're right. Technology has enabled pioneering businesses to ratchet ahead of the competition and, in some cases, trigger information revolutions within and across vertical industries. It is replacing conventional warfare, and it is redefining marketplaces. Once-absurd notions — a computer on every desk, Dick Tracy-like communicating wristwatches — have long since become reality. We keep cramming more and more power into microscopic circuitry. And yet we have barely scratched the surface.

Many of the visionaries whose imagination and drive have brought us these advances aren't resting on their laurels. That's why we devoted a major chunk of our anniversary issue to probing their current obsessions and longer-term predictions.

As a group, these visionaries say that ubiquitous, embedded technology will enhance and improve our lives and that wireless will explode everywhere, as computing and communications converge, voice recognition and video take center stage and personal identifiers and tracking come of age. Other coming benefits include less of a need to travel, increased productivity, advanced problem-solving and simply more opportunities. The visionaries talk about concepts like the "architecture of coordination" and "Internet telemetry and control" while criticizing the quality and complexity of the products produced today.

A more deeply computerized and connected universe can only call for more IT workers at every level, even if it forces a radical overhaul of how they're employed today. After 35 years, this isn't the end of the road, nor is it the end of your careers.

You don't need to be a visionary to conclude that IT has spent the past three decades just getting warmed up. We know, without knowing how, that technology will become ever more central to our personal, business and national interests. How that shakes out for IT professionals is in great part up to us. We just have to be open to the possibilities. They seem endless to me. ◗

PIMM FOX

1967 Shows The Past Isn't Prologue

IF YOU'VE GOT top technology and are attracting top talent, you're a shoo-in for future success as an IT vendor, right? Maybe. Using the past to predict the future sounds like a good idea, but it doesn't always compute.

Today, there's a lot of hand-wringing about the dominance of Microsoft and Cisco Systems, and much of it is based on how powerful those companies have been virtually since their inception. Many people believe that their monopolies will persist indefinitely. And there's some history to support those concerns. For example, 35 years ago, IBM was crushing its competition with its new 360 series mainframe, giving rise to its eventual antitrust problems.

PIMM FOX is a freelance writer in San Francisco. Contact him at pimmfox@pacbell.net.

The popularity of the 360 system prompted aggressive searches for IT talent by IBM, not unlike those of recent years by leading IT vendors. Indeed, advertisements in a 1967 issue of *The New York Times* tried to lure the best and the brightest to work as 360 and Cobol programmers — as long as they possessed the ability to do block diagramming.

Predicting IBM's continued success back then would have been a snap based on its storied history and its dominant market position, especially if you looked at the woes of its competitors at the time.

General Electric was behind IBM in technology and was getting hammered in 1967 by somber reports of bugs in its 600 series computers. There were so many problems that the machines were recalled and GE's French partner, Bull, stopped selling them altogether. Suggesting then that GE's long-term prospects in computing were dim was-

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computerworld.com/columns

n't hard. But to imply that the company would have fallen on hard times as a result would have been dead wrong.

Data communications is one area where we learn that an impressive business history and leading position in the present aren't enough on which to bet the future. (Steve Ballmer and John Chambers, take note.)

In 1967, Western Union was hailed as the leader in data communications in the U.S., a role it lost quickly. This despite the company's rich history and aggressive recruitment of top technical talent, luring engineers with a progressive work environment and "a shirt-sleeve approach to systems problems with patience and imagination." That sounds groovy, and the promised 35-hour work week, with no travel, came with a starting salary of $12,000. The "outstanding and understanding" supervisors at Western Union possibly offset the wage scale. That and no block diagrams. Still, the company's data comm ascendancy was brief.

History proves that having leading technology and attracting top talent can guarantee business success. Or not. ▶

MICHAEL GARTENBERG

Tomorrow's Computers Benefit All

COMPUTERWORLD'S 35th anniversary raises the obvious question about what the next three and a half decades have in store for IT. But to fully grasp what lies ahead, you need to keep in mind the relative pace of change that's driven by technology, and our capacity to understand those changes.

Imagine that we took a person who lived 2,000 years ago and transported him in time to 1800. How would that person find life and civilization? Not too different. Yes, he might need to adjust to certain changes, but overall he would fit in. He would be able to exist as part of that society.

Now imagine that we took a person of a mere 200 years ago and brought him forward into our day. I dare say that person would be overwhelmed in almost every aspect of our day and age. From telecommunications to entertainment, from the Internet to transportation, life would be foreign, alien and beyond any of the mythologies of that person's day.

In my view, the greatest changes have occurred over the past 35 years. We live in an age of instant access and communication, an age when anyone can use a cheap PC and Internet access to get the answer in seconds to any question that has a factual answer or every opinion on any question that can be answered with an opinion.

MICHAEL GARTENBERG is research director at the Client Access and TechnologiesGroup of Jupiter Research in New York. Contact him at **michael.gartenberg@mindspring.com.**

The next 35 years will be even more amazing. Technology moves unfettered by individuals, governments and legislation. Like water, it seeks its own level and can be channeled for good or evil and bring greatness or despair. Moore's Law continues unabated with each generation of better computing performance, bringing new innovation, new challenges and opportunities for growth. The result will be that in 35 years, the machines we have created are likely to match the human brain in terms of capacity and perhaps even capability. Networked globally, these computers will be able to help us overcome many of the problems we face as a society.

We have shrunk the global world. We have broken the barriers that can divide us, thanks to the technology that permits us to speak anywhere to anyone in the world at any time and share information and ideas instantly. In the future, we will further refine the notion of access to information and retrieval. We will learn to share the sum of our knowledge and use it to achieve what we cannot yet imagine today.

The one thing that is certain is that whatever we project for the next 35 years, it will be wrong. Ma Bell never envisioned a world where every home (much less every person) would have a telephone. The founder of IBM thought there might be a worldwide market for perhaps five computers. We will be proved wrong as well. Our children and grandchildren will shape the future.

And like our person transported to the future, it will be interesting to see how we as a generation fit in a future 35 years hence. I personally look forward to watching *Computerworld* chronicle the journey. ▶

READERS' LETTERS

No Rush for XP Upgrade

LET'S BE FAIR: The 25-respondent sample cited in your article "Windows XP Slow to Gain Foothold" [QuickLink 32873] is hardly sufficient to come to any conclusions. Still, if true, we shouldn't be surprised that XP hasn't yet replaced 2000 in the corporate world. As pointed out, the sluggish economy has reduced corporate expenditures, but we also can't ignore that XP is a transition product whose primary strength is performance enhancements and stability; it is *not* a feature-rich enhancement of Windows 2000. Sluggish economy aside, even forward-looking corporations (or educational institutions) can't make a large-scale switch in operating systems more than once every two to three years, and three to four years is more realistic for most. On that basis, the switch will happen only as corporations replace outdated systems with new ones that have XP Pro preinstalled. Until then, the main impetus for corporations to upgrade to XP will come from those employees who like the sleek, new (although inconsequential) interface on their home computers.

C. Marc Wagner
Services development specialist
Indiana University
Bloomington

IT's WLAN Negligence

I HAVE BEEN trying to wake up people to the problem described in the article "Airport WLANs Lack Safeguards" [QuickLink 32879] for over a year. I have "war-driven" several large hospitals in the Los Angeles area and was able to detect dozens of WAPs that were totally open and that had SSIDs such as "Default." When presented with this information, the IT management generally became very defensive and simply didn't want to be bothered. They seemed to be in denial. I have even been told that the data wasn't confidential and didn't require protection, despite the fact that the lack of security afforded access to the network infrastructure. I have devised a strategy for a layered approach to wireless security that's relatively easy to implement with commercial off-the-shelf products. Not using wireless networking because it's insecure is analogous to saying that one shouldn't use automobiles because if you park them with the keys in the ignition and the doors unlocked, they will be stolen.

Richard C. Grosser
Los Angeles

Choose Your Fat Wisely

REGARDING Robert Mitchell's Aug. 26 column, "The Desktop Diet Plan" [QuickLink 31960], the real issue is where the fat resides in relation to the user. Most applications are written for the fat-client environment, so they run locally even when server-based. You get a bandwidth usage surge every time a user starts an application, though that settles down to 20,000 baud during continued usage. Many companies have large departments where only one or two applications are allowed to be run on a computer with high network connectivity requirements — fat-server material for sure. But in many companies, the applications being run aren't even available for servers. And laptop users often work without network connectivity and must have fat clients. Before you invest in fat servers, make sure your users don't depend on any fat clients.

Wayne Wilcox
Speedway, Ind.

A Linux Alternative

ONE COMMENT on the article "Vendors Try Again With Desktop Linux" [QuickLink 32242]. This isn't really unexplored ground. Apple has been providing *nix on the desktop for years. In fact, the latest version sold over 100,000 copies in the first weekend. Admittedly, the kernel isn't the same, and Mac OS doesn't have the illusion of being free that the big Linux distributions have, but it is a working, well-received example of *nix on the desktop.

Raymond DeGennaro
Rockford, Ill.

COMPUTERWORLD welcomes comments from its readers. Letters will be edited for brevity and clarity. They should be addressed to Jamie Eckle, letters editor, Computerworld, PO Box 9171, 500 Old Connecticut Path, Framingham, Mass. 01701. Fax: (508) 879-4843. E-mail: letters@computerworld.com. Include an address and phone number for immediate verification.

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LARRY GOODE

REPORTING On a REVOLUTION

In our special **35TH ANNIVERSARY ISSUE,** Computerworld looks back on technology's journey through the **REVOLUTIONARY PROJECTS AND INDUSTRIES** that continue to drive innovation — and looks ahead with predictions from IT's **PIONEERS AND VISIONARIES.**

CELEBRATING 1967 35 YEARS IT LEADERSHIP 2002

Editor's Note

IN 1967, when *Computerworld* first rolled off the presses, business had already begun its love affair with technology. In this early stage of the relationship, IT professionals were often relegated to work in the basement, where they struggled to validate their contributions to their companies' bottom lines.

What a difference 35 years make. In 2002, CIOs have the reins of million-dollar budgets. The fortunes of their companies rise and fall with the successes and failures of technology. During their climb to the top of corporate America, this new class of IT professional found a voice in *Computerworld.* Now it's time to revisit technology's journey, from promising contributor to the central role it plays in today's economy.

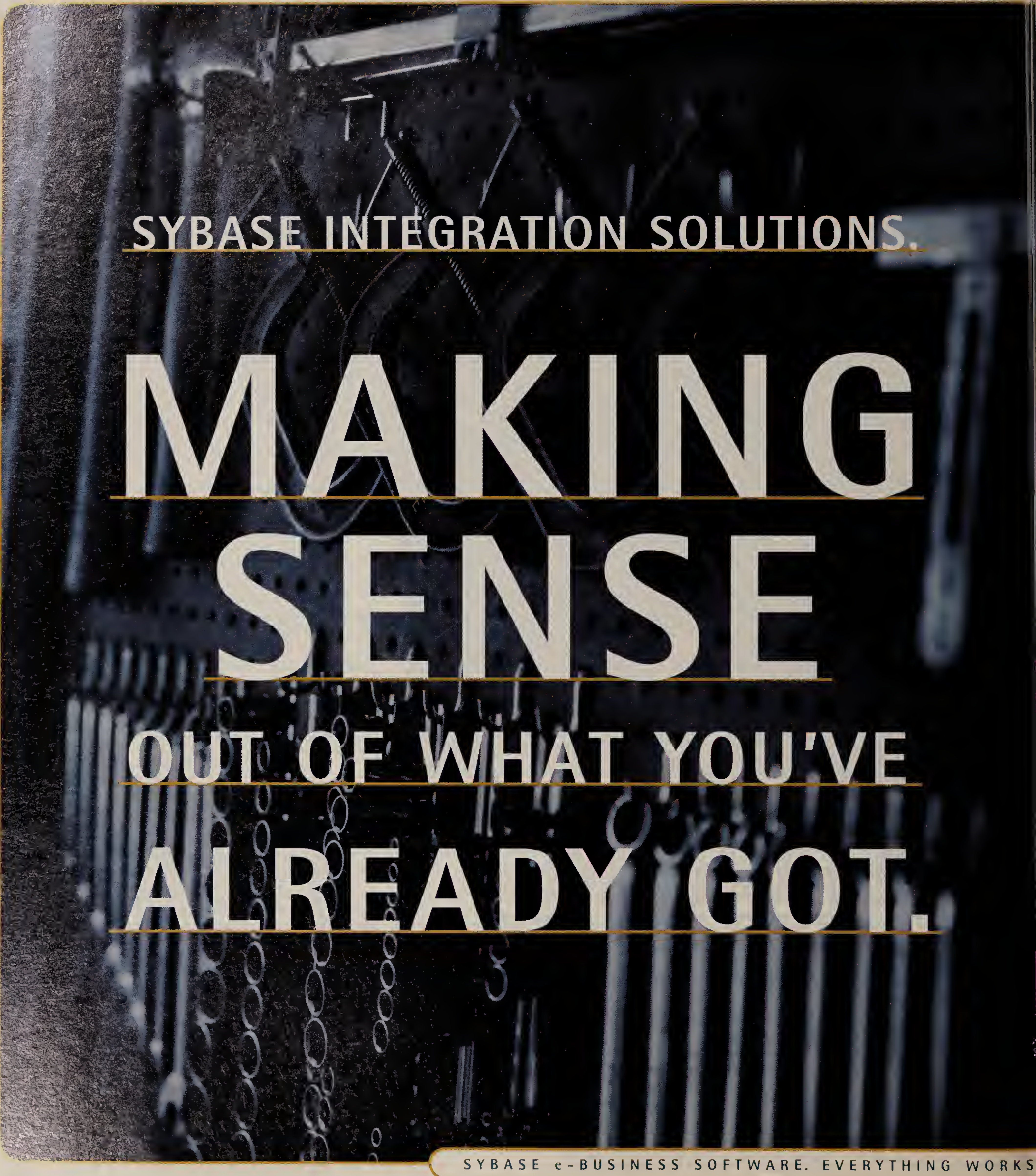
In our featured piece, "35 Technologies that Shaped the Industry" (*page 24*), writer Russell Kay chronicles the early inventions that had the greatest impact on IT, from dynamic RAM to the LaserJet printer. In "Evolution of the IT Leader" (*page 28*), writer Kathleen Melymuka takes a stroll down memory lane with four industry luminaries. Among the first to hold the CIO title, these men discuss the IT leader's steady ascent from the back office to the boardroom.

As technology's significance grew, there were key projects and industries that broke entirely new ground. Robert L. Scheier travels back in time with the Sabre reservation system, which helped revolutionize air travel in its day ("Technology Takes Flight," *page 34*). In "Signed, Sealed and Delivered" (*page 50*), writer Steve Ulfelder recounts the game of one-upmanship that has kept FedEx and UPS in the vanguard.

A look back on 35 years wouldn't be complete without talking with the visionaries who saw the future, the business people who brought their ideas to market and the early IT professionals who created the mold for today's IT leader (*profiles begin on page 54*). We asked these people to predict what innovations will astound us next.

Whether those predictions are right or wrong, *Computerworld* will be there to report on events as they occur. We look forward to spending the next 35 years helping you keep abreast of the IT industry. ◆

Ellen Fanning is special projects editor at Computerworld.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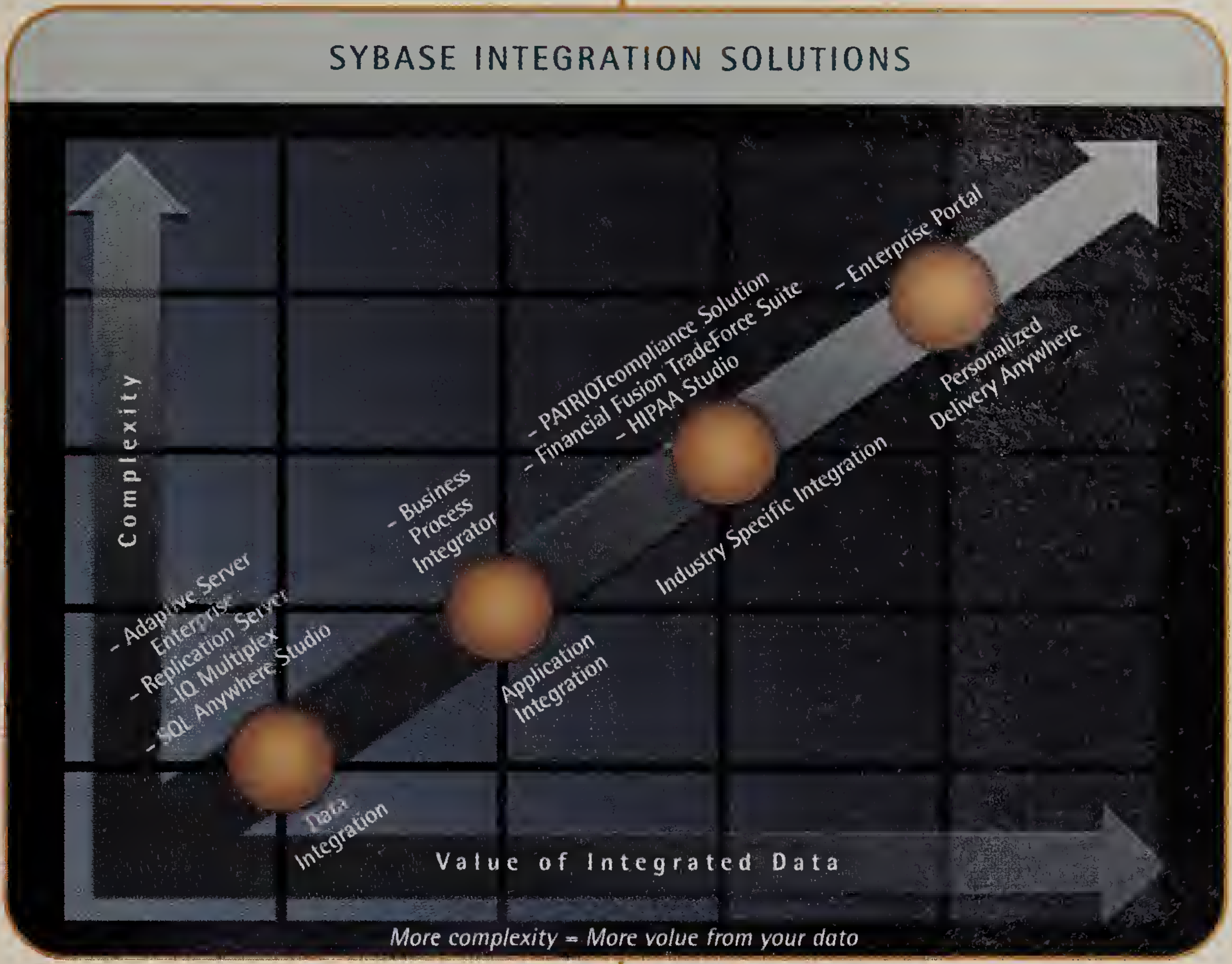
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35 TECHNOLOGIES That Shaped THE INDUSTRY

To celebrate Computerworld's 35th anniversary, we looked back over the years to find the **35 MOST IMPORTANT ADVANCES** in corporate IT. By Russell Kay

WHEN *COMPUTERWORLD* PUBLISHED its first issue in 1967, the private sector was still using vacuum tubes to exchange information. Technology and the world it has shaped have come a long way since then. To commemorate *Computerworld*'s 35th anniversary, here's our list of the 35 products and technologies that have had the greatest impact on enterprise IT since 1967.

1 DYNAMIC RAM

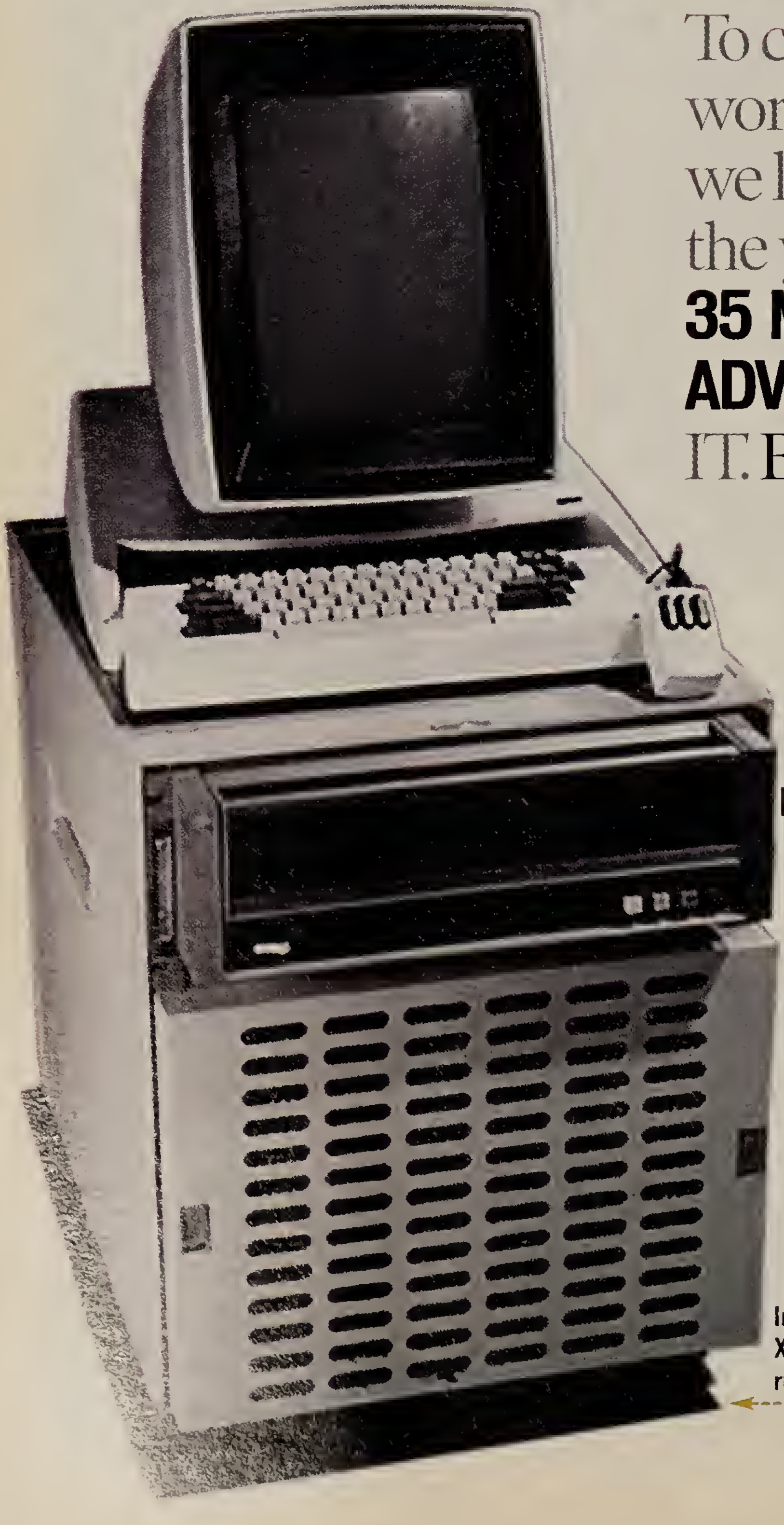
You can't process information unless you can store it and make it available to a computer. Before dynamic RAM, or DRAM, storage was unreliable (vacuum tubes), excruciatingly slow (punch cards, paper or magnetic tape) or incredibly expensive (magnetic core).

In 1966, IBM's Robert Dennard found a way to store a memory bit as a charge on a capacitor in a single-transistor cell. Patented in 1968, this became the foundation for Intel Corp.'s 1970 introduction of a 1K bit memory chip, which was 10mm sq. and sold for $21. Chip-based memory could be made quickly and cheaply, and by the mid-1970s, DRAM was the standard for virtually all computers.

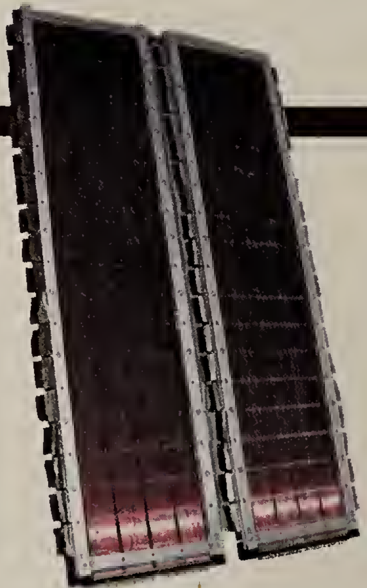
2 GRAPHICAL USER INTERFACE

Programs and data used to be fed into a computer as line-by-line entries on punch cards or tape and were invoked by arcane scripts specific to a particular hardware and software combination. The first real break from this came in 1973, when researchers at Xerox Corp.'s Palo Alto Research Center (PARC) created the Alto computer. This machine combined all the elements of what we now call the graphical user interface, or GUI: graphical windows and icons on a bit-mapped display navigated by a mouse with buttons.

An Alto descendant, the Xerox Star, became a commercial (if not successful) product in 1981. Steve Jobs liked the idea so much, he borrowed it for Apple Computer Inc.'s Lisa and Macintosh. After a succession of false starts, Microsoft Corp. joined the GUI club in 1990 with Windows 3.0, and Windows is now the world's de facto standard for computer interfaces. The old-fashioned command line is still available, but most users and tasks use Windows.



Introduced in 1973, the Xerox Alto was the forerunner of today's GUI.



The DRAM chip, patented in 1966, made reliable, fast and cheap storage possible.

Developed in 1973, the Winchester disk's lightweight heads "flew" just above the surface of the disk.

3 INTERNETWORKING

Computers are infinitely more capable when connected. There were a few networked computers in the 1960s, but the first real wide-ranging connections were introduced by the U.S. Defense Department's Advanced Research Projects Agency with 1969's Arpanet. Arpanet's real contribution was that it recognized the potential of the computer to be more than a high-speed calculator; it could serve as a communication medium among people.

Arpanet pioneer David Clark of MIT sums it up this way: "It is not proper to think of networks as connecting computers. Rather, they connect people, using computers to mediate. The great success of the Internet is not technical, but [its] human impact."

4 MICROPROCESSORS

In the 1960s, computers were huge, expensive and accessible only in government labs, universities and large corporations. The microprocessor changed that.

It started when a Japanese calculator maker asked Intel to design a set of 12 custom chips. Intel engineer Ted Hoff had a better idea: He designed a single-chip, general-purpose logic device that got its instructions from solid-state memory. As part of a four-chip set, this CPU could be plugged into a variety of applications without needing to be redesigned.

Intel launched the 2,250-transistor 4004 in 1971. The $200 chip delivered as much computing power as the earlier Electronic Numeric Integrator and Calculator, whose 18,000 vacuum tubes took up 3,000 cubic feet. Today's Pentium 4 CPUs pack 55 million transistors onto a piece of silicon about 2 sq. in., and nearly every computer in the world is microprocessor-based.

5 ELECTRONIC SPREADSHEETS

In 1978, Harvard Business School students Dan Bricklin and Robert Frankston were tired of dealing with numbers on paper and the inevitable erasures. To simplify their homework, using the then-new Apple II computer, they came up with VisiCalc, a self-calculating, interactive ledger-sheet program. VisiCalc's power, and the secret behind its lasting influence, was that it let nonprogrammers use a computer to do real work, like preparing budgets. In fact, VisiCalc users could do things mainframe users couldn't: enter numeric data and immediately see its effect on other numbers. Later, Lotus 1-2-3 advanced the technology with greater speed, file management functions and the ability to present data visually, in the form of graphs.

The electronic spreadsheet was arguably the first "killer" application, powerful enough to change the perception of the microcomputer as a toy to that of a legitimate business tool. Virtually every spreadsheet program today, including Microsoft Excel, uses the basic structure and interface pioneered by VisiCalc.

6 UNIX

Created in 1969 at AT&T Bell Laboratories to make porting applications easier, the Unix operating system first found a home at universities, which could license the source code for free. It later became a mainstay on corporate servers, in small businesses and finally as the backbone for the Internet.

7 UNBUNDLED SOFTWARE

Prior to 1969, hardware and software weren't sold separately. You bought software from your hardware vendor or wrote it yourself. Faced with a federal antitrust lawsuit, IBM separated its product lines in 1969, cutting hardware prices by 3% and launching the commercial software industry.

8 GENERALIZED MARKUP LANGUAGE

The grandfather of HTML and XML was born in 1969 of a simple idea: Separate content from format, and it will be easier to find information in digital documents. Three IBM staffers solved the problem in a way that opened up new processing potential. No one uses GML anymore, but its descendants are critical to modern IT.

9 RELATIONAL DATABASE

IBM researcher Ted Codd defined the relational model for databases in 1969. Based on that concept and its query language, Oracle Corp. shipped the first SQL relational database system in 1979.

10 WIRELESS NETWORKING

In 1971, the first wireless LAN (WLAN) connected seven University of Hawaii computers on four islands via packet-based radio. But wireless remained a niche technology until the IEEE 802.11 standard emerged in 1997. Despite security concerns, WLANs are proliferating in offices, homes and public spaces.

11 INTERNET E-MAIL

Mainframe electronic mail had been used since the mid-1960s, but in 1972 it became a powerful collaboration tool connecting researchers on the Arpanet, the precursor to today's Internet.

12 WINCHESTER DISK

The first hard disks appeared in the '50s, but in 1973, IBM engineers created a new design with lightweight read/write heads that "flew" just above the surface of the disk platter. The technology, still known by its original code name, cut the cost of storage dramatically and became the standard for two decades.

13 DATA ENCRYPTION STANDARD

The first industry standard for strong encryption, Data Encryption Standard (DES) was developed by IBM and approved by the U.S. National Bureau of Standards in 1975. DES made it practical to routinely send encrypted information electronically, paving the way for e-commerce and virtual private networks.

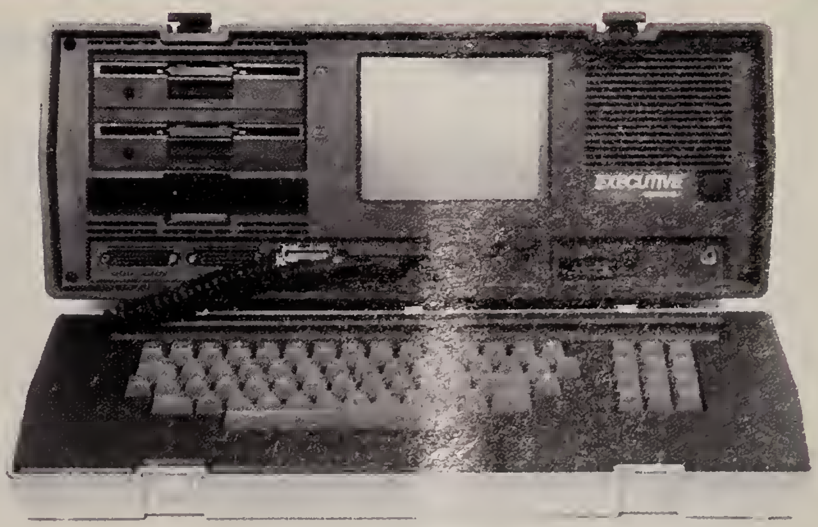
14 ETHERNET

Developed in the early 1970s by Bob Metcalfe at Xerox PARC, Ethernet was the first LAN designed to network hundreds of computers and printers inexpensively. It rapidly overtook its competitors and now dominates the world's LANs, with a speed that has increased from the original 2.94M bit/sec. to the current 10G bit/sec.

15 THE IBM PERSONAL COMPUTER

Introduced in 1981, the IBM Model 5150's open hardware architecture was amenable to third-party add-ons, and its quick-and-dirty design — produced in less than a year — was easy for rivals to copy. The computer industry would never be the same.

The IBM Model 5150, introduced in 1981, had a quick-and-dirty design that would launch the PC industry.



The Osborne computer, which debuted in 1981 at 24 lb., was the first portable computer.

16 THE PORTABLE COMPUTER

Adam Osborne created the first "portable" computer, introduced in 1981 at 24 lbs. with a 5-in. screen. Later, portables got smaller, and today's lightweight laptops make road warriors and students productive and mobile.

17 NETWARE

Novell Inc.'s 1982 network operating system was fast, reliable and could handle 250 users on one server. In short, it was the first network that was practical for businesses to use. NetWare became the departmental standard before losing ground to Windows NT Server in the 1990s.

18 THE LASERJET PRINTER

In 1969, Xerox's Gary Starkweather combined photocopier technology with laser imaging to create a fast, high-resolution (and very expensive) computer printer. But it was Hewlett-Packard Co. that built laser-beam xerography into its moderately priced LaserJet printer in 1984, instantly raising the speed and image quality of computer printing and making desktop publishing practical.

19 LOTUS NOTES

Ray Ozzie's 1989 vision of document-based collaborative software combined group messaging, online discussion, group calendars, phone books, document databases, forms and workflow with a powerful development environment. It made "groupware" a business reality.

20 THE OFFICE SUITE

All-in-one productivity packages weren't considered competition to "real" word processors and spreadsheets until 1990, when Microsoft packaged its top-of-the-line desktop applications together in one box. Microsoft Office quickly established a new standard. By better integrating its components and aggressively marketing Office to business users, Microsoft overwhelmed former category leaders like WordPerfect, Lotus 1-2-3 and dBase.

21 MICROSOFT WINDOWS 3.0

It took five years from Windows 1.0's 1985 introduction for Microsoft to get its GUI-based operating system right, but in 1990, it began bundling Windows 3.0 with a large number of PCs. New development tools helped corporate programmers write graphical software, which could finally use more than DOS's 640KB of memory. Five years later, customers stood in line at computer stores at midnight to get a copy of its successor, Windows 95.

22 WINDOWS NT

It was originally going to be a new version of OS/2, Microsoft's ill-fated collaboration with IBM. But when Windows NT debuted in 1993, it was Microsoft's bid to take on IBM, Novell and Unix with a server-friendly, heavy-duty operating system. With its low cost, NT eventually eclipsed NetWare, forced many Unix vendors to switch to NT and became a mainstay of departmental computing.

23 THE WORLD WIDE WEB

It was just a project at the Swiss research lab CERN until 1993, when Marc Andreessen's graphics-friendly Mosaic browser shaped the Web into its present form. Built on the backbone of the Internet, the Web, with its Hypertext Transfer Protocol, quickly became the primary means of presenting information on networks and soon turned into a vehicle for everything from e-commerce to paperless offices.

24 JAVA

It wasn't clear in 1995 that the world needed another programming language, but Sun Microsystems Inc.'s lightweight, object-oriented Java looked perfect for small programs that could be sent across the Internet as part of Web pages. Java found a better niche as an alternative to C++ for server-side applications and was the model for Microsoft's C# language.

25 PERSONAL DIGITAL ASSISTANTS

Apple's 1993 Newton was a spectacular flop. But the simpler 1996 Palm device was small enough and smart enough to be really useful. With added wireless networking, handheld computers mean corporate data is available almost anywhere — provided that IT shops can figure out how to cope with them. ◗

Kay is a Computerworld *contributing writer in Worcester, Mass. Contact him at russkay@charter.net.* Computerworld*'s Robert L. Mitchell and Frank Hayes also contributed to this article.*

Small and smart, the PalmPilot made its debut in 1996.

The HP LaserJet, introduced in 1984, brought desktop publishing to the masses.

Rounding Out The Top 35

FINALLY, OUR LIST WOULDN'T BE COMPLETE without a nod to these 10 technologies:

26. CICS. IBM's Customer Information Control System was developed in 1968 and is still the most important mainframe transaction processing software in the world.

27. Removable storage. IBM's 1971 8-in., 400KB floppy disk is the ancestor of all removable storage devices, right down to flash memory cards and multigigabyte DVDs.

28. Word processors. Wang Laboratories Inc. launched the first dedicated electronic word processor in 1971. Within a decade, desktop computers ran word processing software, and in another 20 years, the typewriter had all but vanished.

29. Bar codes. Scanning bar codes wasn't especially practical until the 1973 standardization on IBM's Universal Product Code started a revolution in business efficiency and manufacturing, making it possible to track inventory in real time.

30. Inexpensive modems. AT&T modems had been in use since 1963, but dial-up communications became cost-effective with Hayes Microcomputer Products' low-cost 1979 Micromodem 100. The Hayes "AT" command set became a standard and made telecommuting practical.

31. Compaq Computer Corp.'s PC clone. After IBM introduced its PC, Compaq created in 1983 the first non-IBM PC clone that could run all IBM PC software, and an industry was born.

32. Linux. Linus Torvalds' 1991 Unix clone, Linux, made open-source software a force to be reckoned with. Now established in data center server applications ranging from Web servers to storage to Internet firewalls, Linux is increasingly being used for mission-critical applications.

33. Portable Document Format. Created by Adobe Systems Inc. in 1993, this electronic document format preserves complex formatting across multiple platforms.

34. Storage-area networks. Breaking storage away from specific individual servers, SANs combined the speed of Fibre Channel storage with network-aware intelligent routing. Developed in the mid-1990s, these networks let any server directly access any data volume.

35. Multimedia convergence. Information is more than letters and numbers, and increasingly, enterprise computers handle video, audio and telephone communications, images and tactile feedback.

CAN'T GET ENOUGH?

Read more about why these 10 technologies deserve a place on our top 35 list:

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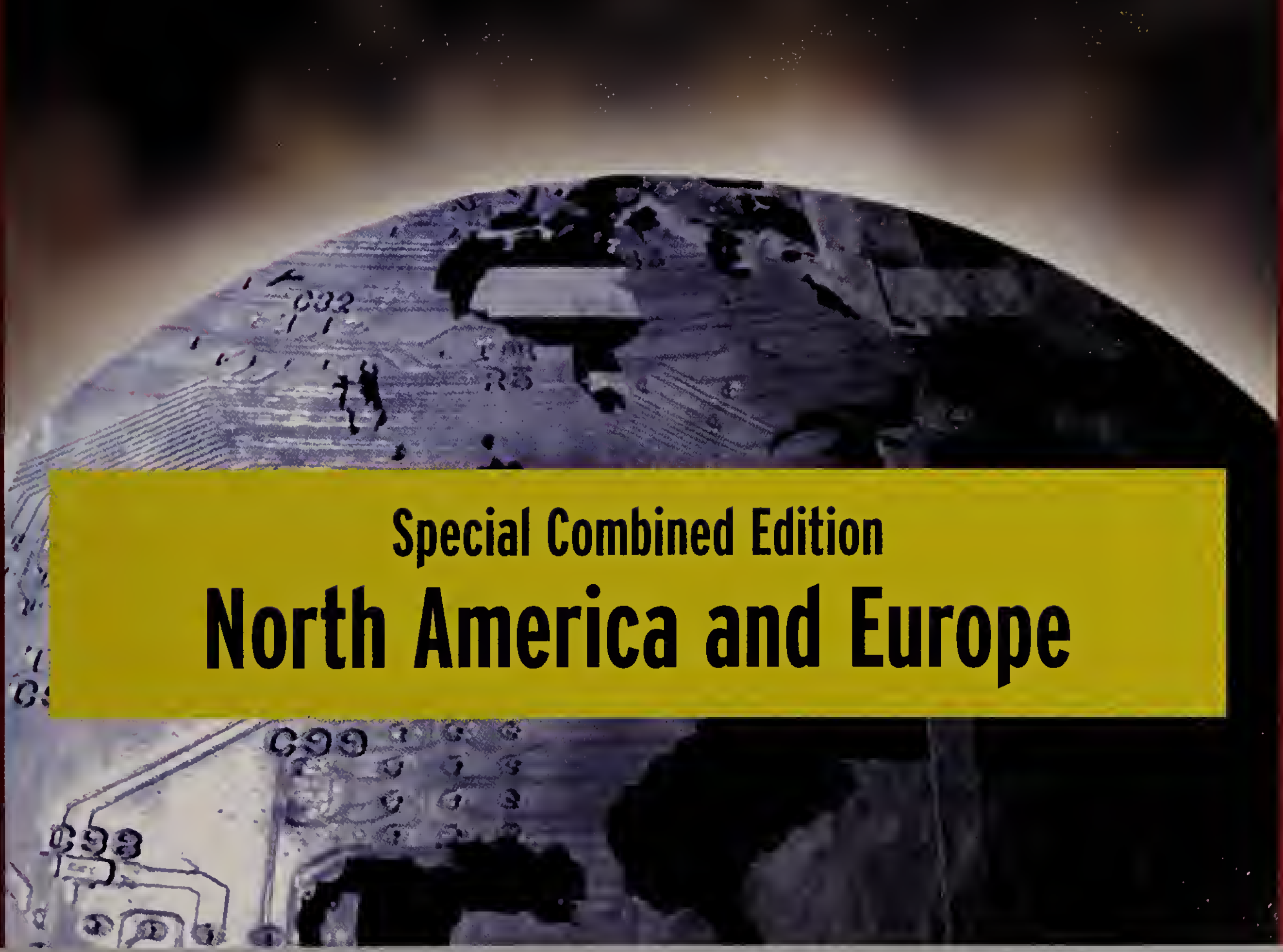

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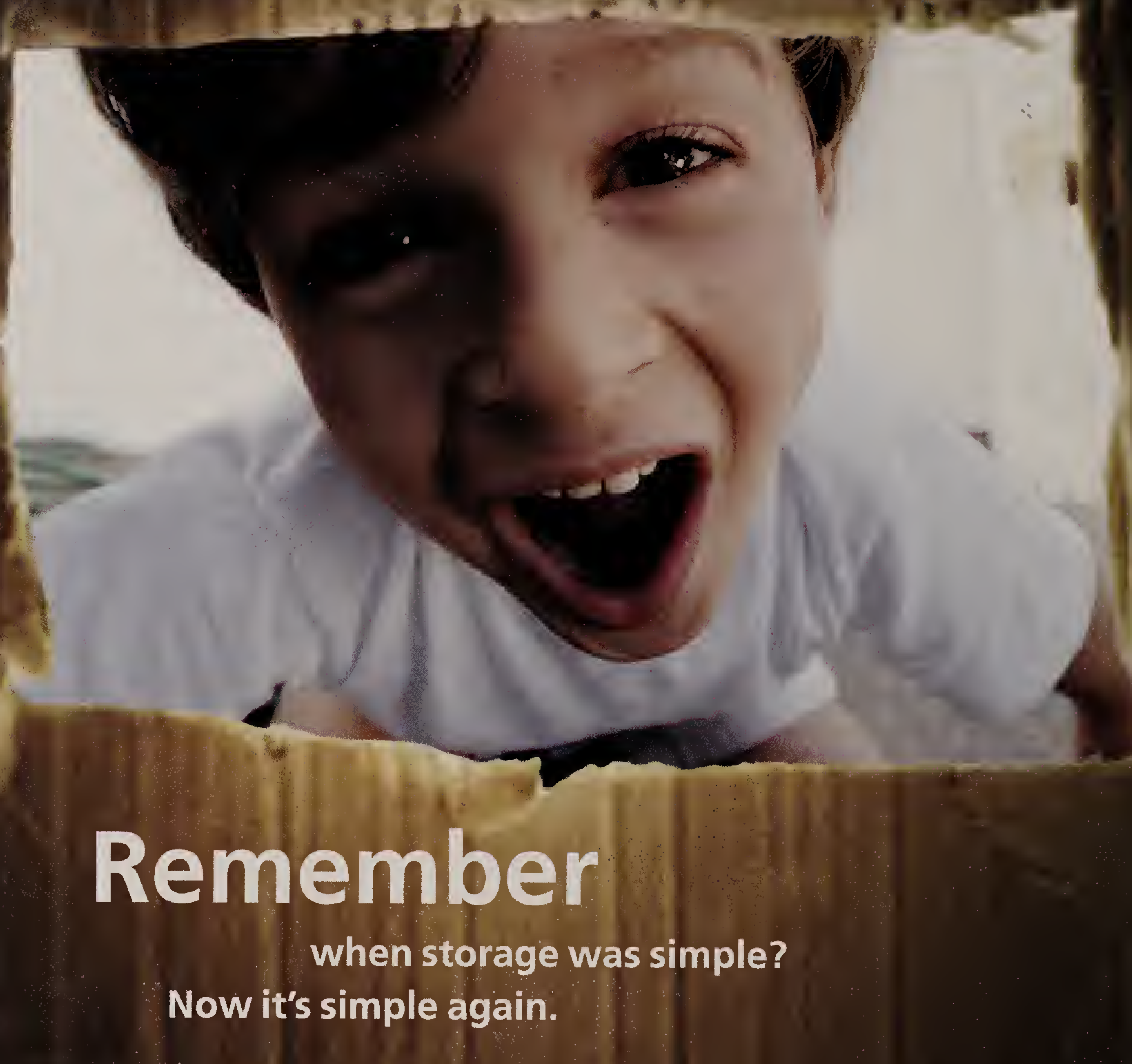

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The Storage Networking Industry Association (SNIA) remains dedicated to promoting the use of highly evolved, widely accepted storage network systems across the IT community – efficient, interoperable systems that meet the needs of today's organizations and can cope with the projected requirements of future applications. This third annual Storage Networking Industry Directory & Buyer's Guide is intended to be the industry's most comprehensive listing of participants in both North America and Europe.

The SNIA's relationship with Computerworld provides the latest information on storage networking and advanced storage technologies to IT users and vendors. Since 1999, our collective vision is to remain the leading source of information, education and guidance for the industry by promoting the evolution and acceptance of industry standards among vendors, implementers and users. We endeavor to accomplish this by producing the highest-quality industry conferences with our twice-annual Storage Networking World® in the U.S. and Storage Networking World®-EuroStorage event in Europe. These feature an unparalleled Interoperability and Solutions Demo program.

This Storage Networking Industry Directory & Buyer's Guide is yet another important component of our integrated industry information offering. We invite you to explore and consider the expertise, resources and storage solutions provided by the companies listed and profiled in this publication in both the North American and European sections.

Regards,
Brad Stamas and Michel Grosbost

SNIA EUROPE

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IDC
Analyze the Future

The storage industry remains poised to provide strategic opportunities and technology advancements for the IT departments of worldwide organizations. IDC continues to project increased demand for networked storage solutions as the benefits of enhanced data management, data security and data availability are realized.

With both global applications and regional deployments, the greatest challenge remains the need to identify proven components of integrated solutions as well as quality vendors, service providers and implementers. Users should insist that their storage-technology suppliers meet interoperability, scalability and reliability expectations.

This unique, annual Storage Networking Industry Directory & Buyer's Guide provides storage-solution seekers with a list of North American and European suppliers and industry experts. IDC is proud to be a leader in analyzing and educating the storage market. We are pleased to again partner with both the SNIA and Computerworld as a sponsor of this valuable resource.

Regards,

John T. McArthur
Group Vice President
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This *Storage Networking Industry Directory & Buyer's Guide* was created and assembled as a custom published Supplement to Computerworld by the Computerworld Strategic Programs unit in conjunction with the Storage Networking Industry Association (SNIA). It is intended to be an annual publication and a key part of the storage market initiatives resulting from Computerworld's unique strategic alliance with the SNIA. Computerworld acknowledges and thanks IDC for its sponsorship of this endeavor. We also say *thank you* to our participants and advertisers in this supplement.

Company listings were compiled from an industry survey conducted by Computerworld's Strategic Programs unit together with association member companies supplied by the SNIA U.S. and European chapters and the FCIA-Europe. Companies listed with a profile and their logo paid a small fee for this upgraded listing – all listed companies were offered this option. The information presented in these profiles, including the designation of the Storage Products and Services marketed by them (see below) and their contacts, was provided directly by the companies themselves. Computerworld, the SNIA and IDC are not responsible for the accuracy of the information provided.

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DM = Data Management
OSM = Online Storage Management
S = Services
SD/S= Storage Devices/Subsystems
SNI= Storage Network Infrastructure
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Tom McCafferty, Chief Technology Officer
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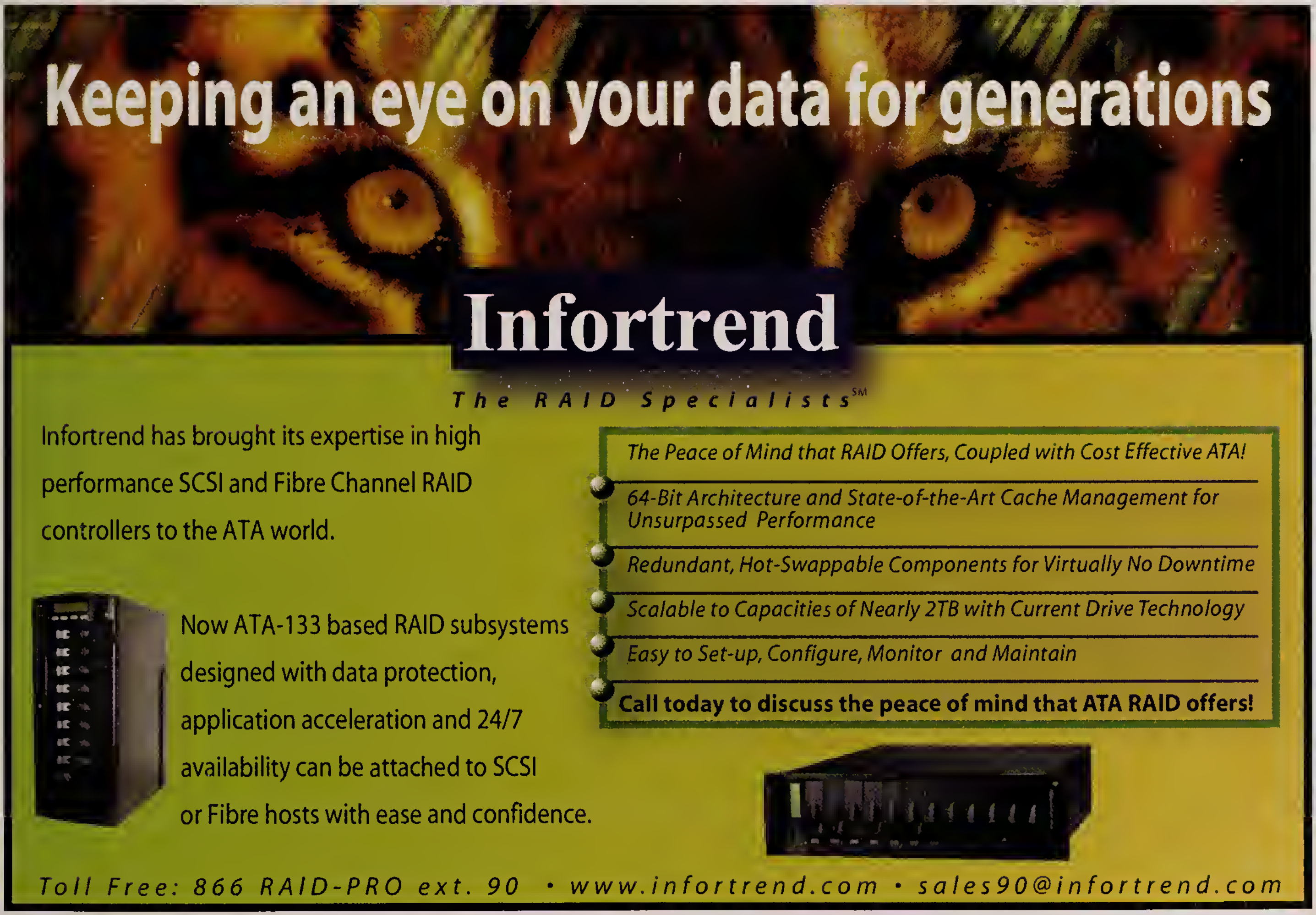

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www.highpoint-tech.com

High Velocity Systems
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www.highvelocitysystems.com

Highlander Corporation
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www.highlandercorp.com

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Santa Clara, CA 95050
www.hds.com
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www.hgai.com

Ibitsco Inc.
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www.ibitsco.com

IBM
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San Jose, CA 95193
www.ibm.com/totalstorage/snd1

Ibrix Inc.
P.O. Box 1403
Princeton, NJ 08542

Idiom Inc.
200 Fifth Ave., 2nd Floor
Waltham, MA 02451
www.idiominc.com

Imation Storage Professional Services
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Oakdale, MN 55128
www.imation.com/storageconsulting
800-650-9262

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kgschwartz@imation.com, 651-704-4258

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San Jose, CA 95112
www.infineon.com

InfiniBand Trade Association
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Portland, OR 97221
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InfiniCon Systems Inc. *(SNIA)*
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William Prosenik, President
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505 Montgomery St., Level 2
San Francisco, CA 94111
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Stuart Barton, Chief Executive Officer
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Scott McCallum, Chief Technology Officer
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InterSAN Inc. *(SNIA)*

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www.intransa.com

Intrinsix Corporation

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Invio Software Inc.

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2001 Corporate Center Dr.
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Irvine, CA 92614
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LiveVault Corporation
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Marlborough, MA 01752
www.livevault.com

Los Alamos National Laboratory
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Los Alamos, NM 87545

LSI Logic Storage Systems Inc.
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Milpitas, CA 95035
www.lsilogicstorage.com
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Monte Evans, Director, Marketing Services
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(SD/S,SNI,S)

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507 Airport Blvd., Suite 111
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Netreon, the SAN design company, develops software that makes it possible for enterprises to design, deploy and manage sophisticated storage environments more quickly, more effectively and with greater confidence. Netreon's products are used by storage professionals in any organization that provides SAN design, planning, deployment or management services.
(DM,SRM)

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2 Castleview Dr.
Brampton, Ontario Canada L6T 5S9
www.openstore.com

Open Systems Solutions
710 Floral Vale Blvd.
Yardley, PA 19067
www.ossi.net

Optical Laser Inc.
5702 Bolsa Ave.
Huntington Beach, CA 92649
www.opticallaser.com

Osicom Technologies
9020 Junction Dr.
Annapolis Junction, MD 20701

OuterBay Technologies
900 E. Hamilton Ave., Suite 200
Campbell, CA 95008
www.outerbay.com

Overland STORAGE SNIA

Overland Storage
4820 Overland Ave.
San Diego, CA 92123
www.overlandstorage.com
800-729-8725

Overland Storage Inc. is a global supplier of innovative hardware and software storage solutions for computer networks. The company's reputation for delivering high-availability products, including the award-winning NEO Series of tape libraries, sets the standard for intelligent, automated storage and scalability. For more information, visit www.overlandstorage.com. *(SD/S,SNI,DM,SRM)*

Pacific Computer Expansions Inc.
23312 Madero, Suite F
Mission Viejo, CA 92691
www.pacexp.com

Pacific Digital Corporation
2052 Alton Pkwy.
Irvine, CA 92606
www.pacificdigital.com
949-252-1111

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E. Chuck Ouellette, Director, Sales
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Pacific Digital is a leading supplier of storage solutions. The DiscStaQ™ family of RAID controllers offers leading-edge performance for Enterprise ATA storage. Featuring embedded Automatic DMA and drive Tag Command Queuing, DiscStaQ™ offers SCSI-like performance at ATA prices and has 45% - 300% more throughput than other ATA controllers. *(SD/S)*

Palm Inc.
400 N. McCarthy Blvd.
Milpitas, CA 95035
www.palm.com

Panasas *(SNIA)*
34790 Campus Dr.
Fremont, CA 94555
www.panasas.com
510-608-7790

Panasas is developing the world's most scalable and agile data storage network. This new generation system combines a distributed file system with smart hardware. The result: exceptional scaling in capacity and performance with an easy-to-manage, virtually boundless storage system. *(SD/S)*

Paralan Corporation
4655 Ruffner St.
San Diego, CA 92111
www.paralan.com

Partners Data Systems
3663 Via Mercado
La Mesa, CA 91941
www.partnersdata.com

Pathlight Technology Inc.
9 Brown Rd.
Ithaca, NY 14850

PDC Solutions Inc.
1002 W. Ninth Ave.
King of Prussia, PA 19406
www.pdc.com

Peak Storage Solutions Inc.
246 S. Taylor Ave.
Louisville, CO 80027
www.peakstor.com

Peerless Systems Networking
2381 Rosecrans Ave.
El Segundo, CA 90245
www.peerless.com

Perfectus Technology
3130 Coronado Dr.
Santa Clara, CA 95054
www.perfectus.com

PerifiTech Inc.
15224 Neo Pkwy.
Cleveland, OH 44128
www.perifitech.com

Peripheral Test Instruments
3345 S. Wadsworth Blvd., Suite 220
Lakewood, CO 80227
www.scsitools.com

Perisol Technology
1148 Sonora Ct.
Sunnyvale, CA 94086
www.perisol.com

Perot Systems
2300 W. Plano Pkwy.
Plano, TX 75075
www.perotsystems.com

Philips Consumer Electronics
64 Perimeter Center E.
Atlanta, GA 30346
www.philips.com

Phoenix International
812 W. Southern Ave.
Orange, CA 92865
www.phenxint.com

Picolight Inc.
4665 Nautilus Ct. S., Suite 3
Boulder, CO 80301
www.picolight.com

Pihana Pacific Inc. *(SNIA)*
1100 Alakea Plaza, Suite 3000
Honolulu, HI 96813

Pinnacle Systems
2411A Plantation Center Dr.
Matthews, NC 28105

PIRUS

SNIA

Pirus Networks
43 Nagog Pk.
Acton, MA 01720
www.pirus.com
978-206-9100

Linda Cafferty, Director, Corporate Marketing
lcafferty@pirus.com, 978-206-9162

Pirus™ develops an intelligent storage switch that enables a single, unified storage network that supports block, file, and IP storage-based needs. The PSX-1000 is designed to support multi-vendor storage and combines key storage and access services like FC, iSCSI, NFS and CIFS with advanced functionality including virtualization, security and point-in-time copying. *(SNI)*

Pixie Lab Inc.
1212 S. Naper Blvd., Suite 119
Naperville, IL 60540
www.datman.com

PKWARE Inc.
9025 N. Deerwood Dr.
Brown Deer, WI 53223

Plasmon *(SNIA)*
400 Inverness Dr. S., Suite 310
Englewood, CO 80112
www.plasmon.com
720-873-2500

Chris Kakias, Director, Marketing Communications
720-873-2500
Andy Richards, Vice President, Systems Engineering
720-873-2500
Greg Pastrich, Director, Sales
720-873-2500

Plasmon provides the industry's most comprehensive line of automated storage libraries, optical drives, disks, library and storage management software, and associated support services. The company's architectural configurations offer the highest level of automated flexibility through the implementation of 5.25" MO (magneto optical), 12-inch True WORM, LTO-Ultrium, DVD-RAM/DVD-R, CD-ROM/CD-R, and media. For more information, visit www.plasmon.com. *(SD/S,SNI,DM,SRM,OSM,S)*

Platypus Technology Inc.
79 E. Wilder Rd.
W. Lebanon, NH 03784
www.platypus.net

Platys Communications
3150A Coronado Dr.
Santa Clara, CA 95054

Plextor Corporation
48383 Fremont Blvd., Suite 120
Fremont, CA 94538
www.plextor.com

PolyServe Inc. *(SNIA)*
4 Embarcadero Center, Suite 540
San Francisco, CA 94111
www.polyserve.com

Portlock Software
65 E. Broadway
Butte, MT 59701
www.portlocksoftware.com

Portsmouth Software
2 Pinecrest Ter., 4th Floor
Portsmouth, NH 03801
www.portsmouthsoftware.com

PowerQuest
P.O. Box 1911
Orem, UT 84059

Primavera
3 Bala Plaza W., Suite 700
Bala Cynwyd, PA 19004
www.primavera.com

Prisa Networks Inc. *(SNIA)*
6620 Mesa Ridge Rd., Suite 200
San Diego, CA 92128
www.prisa.com
858-677-0362

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Bill Leonard, Vice President, Sales
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Prisa Networks Inc. develops management software for Server Area and Storage Area Networks built upon Fibre Channel, InfiniBand™, and high-speed Ethernet technologies. Prisa's flagship product line, VisualSAN®, consists of two market-focused product suites: the VisualSAN Network Management Suite and the VisualSAN Remote Support Suite. *(SRM)*

Proactive Technologies
13735 Beta Rd.
Dallas, TX 75244

ProactiveNet
2150 Gold St., Silicon Valley
Alviso, CA 95002
www.proactivenet.com

Procom Technology *(SNIA)*
58 Discovery
Irvine, CA 92618

Promark Technology
10810 Guilford Rd., Suite 101
Annapolis Junction, MD 21046
www.promarktech.com

Prompt 2U
33 Boston Post Rd., Suite 270
Marlborough, MA 01752
www.prompt2u.com

ProvisionSoft

SNIA

ProvisionSoft
100 Brickstone Sq.
Andover, MA 01810
www.provisionsoft.com
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ProvisionSoft, a high-growth company offering DynamicIT, a new generation of proactive resource management software for IT datacenters. DynamicIT redefines infrastructure resource management by adding intelligence and proactivity to the science of provisioning IT resources. DynamicIT lowers data center costs, improving the return on investments made in storage and server resources. *(SRM)*

PTI
2231 Crystal Dr., Suite 714
Arlington, VA 22202
www.pti.com

Qlogic *(SNIA)*
26600 Laguna Hills Dr.
Aliso Viejo, CA 92656

Qstar Technologies
99 N.E. Eglin Pkwy., #37
E. Walton Beach, FL 32548
www.qstar.com

Quad Research
5 Whatney
Irvine, CA 92618
www.quadresearch.com

Quantum/ ATL
P.O. Box 57100
Irvine, CA 92619
www.quantum.com
949-856-7800

Rob Pickell, Vice President, Marketing
Steve Reichwein, Product Manager
Gary Koopman, Vice President, Sales

Quantum Corporation provides backup, archiving, and recovery of business-critical data through solutions that deliver high performance, reliability, cost-effectiveness, and scalability. Quantum is the world's largest supplier of DLTtape™ drives and automation systems, with a range of tape libraries for workgroup, departmental, mid-range, and enterprise-class applications, and is the category leader in workgroup network attached storage appliances. *(SD/S,S)*

Quantum Bridge Communications
Two Tech Dr.
Andover, MA 01810

Quantum/DLT Tape
501 Sycamore Dr.
Milpitas, CA 95035
www.quantum.com
408-944-4000

Andy Grolnick, Vice President, Marketing,
Quantum DLTtape Group
Duncan Furness, Vice President, Engineering,
Quantum DLTtape Group
Tony Corrozzo, Vice President, Worldwide Sales,
Quantum DLTtape Group

With an installed base of nearly 2 million DLTtape drives in use, more than 80 million DLTtape media cartridges, DLTtape technology is the standard for backup and archiving of business-critical data. Quantum's SDLT 320 delivers 160 GB and a transfer rate of 16 MB/s. Future generations of Super DLTtape drives will store more than one terabyte of capacity per data cartridge. Find out more at www.superdlttape.com. *(SD/S,DM,S)*

Quantum/Snap Server
2001 Logic Dr.
San Jose, CA 95124
www.snapserver.com

Quartet Network Storage
3003 N. First St., Suite 317
San Jose, CA 95134
www.quartetns.com

QVS Inc.
2731 Crimson Canyon Dr.
Las Vegas, NV 89128
www.qvs.com

Radiant Software
3000 W. Olympic Blvd., Suite 2510
Santa Monica, CA 90404
www.radiantsw.com

Raid Storage
13000 Murphy Rd., Suite 114
Stafford, TX 77477
www.raidstorageinc.com

RAIDCore
71 Spit Brook Rd., Suite 304
Nashua, NH 03060
www.raidcore.com

Rainfinity
2740 Zanker Rd., Suite 200
San Jose, CA 95134
www.rainfinity.com

Rancho Technologies Inc.
10783 Bell Ct.
Rancho Cucamonga, CA 91730
www.rancho.com

Rand Worldwide
2030 E. Algonquin Rd., Suite 402
Schaumburg, IL 60173
www.rand.com

Rave Computer Association Inc.
36960 Metro Ct.
Sterling Heights, MI 48312
www.rave.com

Raytheon eCenter Technologies
16800 E. CentreTech Pkwy., M/S 3501
Aurora, CO 80011
www.ecentertech.com

Read-Rite Corp.
44100 Osgood Rd.
Fremont, CA 94539
www.readrite.com

Redswitch
1815 McCandless Dr.
Milpitas, CA 95035
www.redswitch.com

Resilience Corporation
920 Stewart Dr., Suite 110
Sunnyvale, CA 94085
www.resilience.com

Rhapsody Networks *(SNIA)*
3450 W. Warren Ave.
Fremont, CA 94538
www.rhapsodynetworks.com

Ricoh Silicon Valley
4 Results Way
Cupertino, CA 95014
www.rsv.ricoh.com

Ricom Inc.
188-N Technology Dr.
Irvine, CA 92618
www.ricom.net

Ridge Technologies
2199 Zanker Rd.
San Jose, CA 95131
www.ridgetechnologies.com

Ringdale
101 Halmar Cove
Georgetown, TX 78628
www.ringdale.com

Rising Edge Technologies
1110 Elden St., Suite 301
Herndon, VA 20170
www.rising-edge.com

RMSI
3235 Sunrise Blvd.
Rancho Cordova, CA 95742
www.teamrmsi.com

Rorke Data Inc.
9700 W. 76th St.
Eden Prairie, MN 55344
www.rorke.com

SAN Solutions
13006 E. Philadelphia St., Suite 405
Whittier, CA 90601

SAN Valley Systems Inc. *(SNIA)*
2105 S. Bascom Ave., Suite 195
Campbell, CA 95008
www.sanvalley.com

SANavigator *(SNIA)*
2040 Fortune Dr., Suite 200
San Jose, CA 95131
www.sanavigator.com

SANcastle Technologies Inc. *(SNIA)*
2107 N. First St., Suite 500
San Jose, CA 95131

SanDisk
140 Caspian Ct.
Sunnyvale, CA 94089

Sanera Systems *(SNIA)*
370 San Aleso Ave.
Sunnyvale, CA 94085
www.sanera.net

Sangate
144 Turnpike Rd.
Southborough, MA 01772
www.sangate.com
508-490-7900

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SANgate provides specialized storage network appliances optimized for high-performance data movement. SANgate's solutions simplify the data replication and recovery functions in the enterprise data center. Designed for mission-critical application environments, the SANgate solutions provide scalability, reliability, availability and serviceability. *(SD/S,DM,SRM,SNI,OSM,S)*

SanOne Inc.
26 W. Lone Cactus Dr.
Phoenix, AZ 85027

Sanrise
7950 Dublin Blvd., Suite 200
Dublin, CA 94568
www.sanrise.com

Sanserve
6381 Osgood Ave. N.
Oak Park Heights, MN 55082
www.sanserve.com

SANtools Inc.
3133 Freedom Ln.
Plano, TX 75025
www.santools.com
972-208-1393

David Lethe
david@santools.com, 972-208-1393

SANtools' SMARTmon software provides predictive failure and status monitoring using TapeAlert, S.M.A.R.T. and SES/SAF-TE standards. The mode page editor and log page viewer facilitate SCSI and Fibre Channel device customization, tuning, and detection of problems ignored by your host and other SRM packages. $90/server, ported to major O/S's. *(SNI,SRM)*

Scale Eight Inc.
625 Second St., Suite 101
San Francisco, CA 94107
www.scale8.com

SCM Microsystems
47211 Bayside Pkwy.
Fremont, CA 94538
www.scmmicrosystems.com

SEAKR Engineering Inc.
6221 S. Raccine Cir.
Centennial, CO 80111
www.seakr.com

Seek Systems Inc.
11715 N. Creek Pkwy. S., Suite 110
Bothell, WA 98011
www.seeksystems.com

Seven Ten Storage Software Inc.
60 Island St.
Lawrence, MA 01840
www.seventenstorage.com

SGI *(SNIA)*
2011 N. Shoreline Blvd., M/S 855
Mountain View, CA 94043
www.sgi.com

Sierra Atlantic
830 Hillview Ct., Suite 100
Milpitas, CA 95035

Silicon City Inc.
354 S. Oyster Bay Rd.
Syosset, NY 11791
www.storageyard.com

Silicon Image
1060 E. Arques Ave.
Sunnyvale, CA 94085

Silverback Systems *(SNIA)*
695 Campbell Technology Pkwy., Suite 150
Campbell, CA 95008
www.silverbacksystems.com

Siros Technologies
101 Dagsett Dr.
San Jose, CA 95134
www.sirostech.com

Sistana Software *(SNIA)*
1313 5th St., Suite 111
Minneapolis, MN 55414
www.sistana.com

Sitara Networks
52 Second Ave., Suite 200
Waltham, MA 02451
www.sitaranetworks.com

SM Data SA
Narcis Monturiol, 11, Poligon Industrial Foinvasa
08110 Montcada i Reixac
Barcelona, Spain 08110

SMS Data Productions Group
1501 Farm Credit Dr.
McLean, VA 22102
www.sms.com

SoftKnot Corporation
46500 Fremont Blvd., Suite 716
Fremont, CA 94538
www.softknot.com

Solid Data Systems Inc.
2945 Oakmead Village Ct.
Santa Clara, CA 95051
www.soliddata.com

Solution-Soft
2350 Mission College Blvd., Suite 777
Santa Clara, CA 95054
www.solution-soft.com

SONY

SNIA

Sony Electronics Inc.
1 Sony Dr.
Park Ridge, NJ 07656
www.sony.com/datasystems
800-829-7669

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Tom Yuhas, Director
tom.yuhas@am.sony.com, 201-930-6978

Sony's tape storage formats: Digital Data Storage (DDS), a 4mm tape format; Advanced Intelligent Tape™ (AIT), an 8mm tape format; S-AIT, a high-capacity, high-performance platform to debut this fall; and Digital Tape Format (DTF). Sony's tape libraries range from low-end desktop storage to high-end enterprise level storage.
(SD/S,DM)

Sosinsky Group
98 High St.
Medfield, MA 02052
www.sosinsky-group.com

Source Communications
2260 Industrial Ln.
Broomfield, CO 80020
www.source-communications.com

SourceTek
233 Vaughan St.
Portsmouth, NH 03840
www.sourceteksystems.com

Southern Technology
271 Oakwood Dr.
Meridian, MS 39305
www.southerntechnology.com

Space for Rent
5135 Avenida Encinas
Carlsbad, CA 92008
www.s4r.com

Spanos Technologies Inc.
4250 N.W. 26th Ave.
Boca Raton, FL 33434
www.spanoscorp.com

Spectra Logic Corporation *(SNIA)*
1700 N. 55th St.
Boulder, CO 80301
www.spectralogic.com

SPINNAKER
NETWORKS

SNIA

Spinnaker Networks
301 Alpha
Pittsburgh, PA 15238
www.spinnakernetworks.com
412-968-SPIN

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Spinnaker Networks delivers next-generation distributed storage systems for enterprise customers and service providers. The SpinServer's innovative distributed architecture delivers unsurpassed scalability and performance in a system that significantly reduces management costs and complexity. Spinnaker was recently named one of UPSIDE Magazine's "Hot 100," which recognizes private companies for innovation, leadership and performance. *(SD/S,SNI)*

Spirent Communications
15200 Omega Dr.
Rockville, MD 20850
www.spirentcom.com

St. Bernard Software
16880 W. Bernardo Dr.
San Diego, CA 92127
www.stbernard.com

Stonefly Networks Inc. *(SNIA)*
10170 Huennekens St.
San Diego, CA 92121
www.stonefly.com

Stonesoft Inc.
115 Perimeter Center Pl., Suite 1000
Atlanta, GA 30346
www.stonesoft.com

Storability Software *(SNIA)*
118 Turnpike Rd.
Southborough, MA 01772
www.storability.com

Storactive
4551 Glencoe Ave., Suite 150
Marina Del Ray, CA 90292
www.storactive.com

Storage Access
4800 N. Federal Hwy., Bldg. A-200
Boca Raton, FL 33431
www.storageaccess.com

Storage Area Networks Inc. *(SNIA)*
900 W. Castleton Rd., Suite 210
Castle Rock, CO 80104

Storage Computer Corporation
11 Riverside St.
Nashua, NH 03062
www.storage.com

Storage Concepts
14352 Chambers Rd.
Tustin, CA 92780
www.storageconcepts.com

Storage Engine *(SNIA)*
One Sheila Dr.
Tintan Falls, NJ 07724
www.storageengine.com

StorageASP
515 Consumers Rd., Suite 405
Toronto, Ontario Canada M2J 4Z2
www.storageasp.com

StorageFlex
80 Shields Ct.
Markham, Ontario Canada L3R 5J6
www.storageflex.com

StorageNetworks *(SNIA)*
225 Wyman St.
Waltham, MA 02451
www.storagenetworks.com

StoragePoint Inc.
9921 Carmel Mountain Rd., #205
San Diego, CA 92129
www.storagepoint.com

StorageProvider Inc.
13201 Northwest Fwy., No. 300
Houston, TX 77040
www.storageprovider.com

StorageQuest Inc.
127 Walgreen Rd.
Carp (Ottawa), Ontario Canada K0A 1L0
www.storagequest.com

STORAGETEK

SNIA

StorageTek
One StorageTek Dr.
Louisville, CO 80028
www.storagetek.com
800-786-7835

Michael R. McLay, Vice President, U.S./Canada Sales & Service
303-673-5151

StorageTek has been delivering storage management solutions for over 33 years. The company offers solutions that are easy to manage and allow universal access to data across servers, media types and storage networks. StorageTek provides IT with confidence and know-how to manage your entire storage management ecosystem. *(SD/S,SNI,DM,SRM,OSM,S)*

StorageWay *(SNIA)*
3501 W. Warren Ave.
Fremont, CA 94538
www.storageway.com

StorageWorks
5727 Burbank Rd. S.E.
Calgary, Alberta Canada T2H 1Z5
www.storageworks.com

StorCase Technology Inc.
17600 Newhope St.
Fountain Valley, CA 92708
www.storcase.com

StoreAge Networking Technologies Inc. *(SNIA)*
One Technology Dr., Bldg. C-515
Irvine, CA 92618
www.store-age.com

Storigen Systems Inc.
650 Suffolk St.
Lowell, MA 01854
www.storigen.com

StorLogic Inc.
100 Technology Pk., Suite 175
Lake Mary, FL 32746
www.storlogic.com

StorNet
1109 Saunders Ct.
W. Chester, PA 19380
www.stornet.com

StorScape
1300 Massachusetts Ave.
Boxborough, MA 01719
www.storscape.com
866-575-1533

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Matt Durkin, Vice President, Global Sales
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StorScape offers the industry's first CIM-based storage management solution and is dedicated to fundamentally changing the storage landscape. StorScape is developing ground-breaking technology that will ease the storage management burden, increase storage infrastructure automation, and reduce the high cost of managing storage assets. The company was founded by Eurologic® Systems and HERMES SoftLab. (SRM)

StraightLine
13410 S.E. 32nd St.
Bellevue, WA 98005
www.str8line.com

Strategic Advanced Management Systems
709 Woodbridge Ct.
Barrington, IL 60010

Strategic Research Corporation
350 S. Hope Ave., Suite A-103
Santa Barbara, CA 93105
www.sresearch.com

Strategic Technologies
301 Gregson Dr.
Cary, NC 27511
www.stratech.com

Stratos Lightwave
7444 W. Wilson Ave.
Chicago, IL 60706
www.stratoslightwave.com

Stratus Computer Systems
111 Powdermill Rd.
Maynard, MA 01754
www.stratus.com

Sun Microsystems *(SNIA)*
500 Eldorado Blvd., UBRM01-241
Broomfield, CO 80021
www.sun.com

SuperComm
2500 Wilson Blvd., Suite 300
Arlington, VA 22221
www.supercomm2002.com

Surgient Networks
8303 Mopac, Suite C300
Austin, TX 78759
www.surgient.com

Sutmyn
P.O. Box 5687
Santa Clara, CA 95054
www.sutmyn.com

SwapDrive
1313 F St. N.W.
Washington, DC 20004
www.swapdrive.com

Sycamore Networks
150 Apollo Dr.
Chelmsford, MA 01824
www.sycamorenetworks.com

Symbol Technology
One Symbol Plaza
Holtsville, NY 11742
www.symbol.com

Syncsort Inc.
50 Tice Blvd.
Woodcliff Lake, NJ 07677
www.syncsort.com
201-930-8200

Vic Werner, Director, Marketing
vwerner@syncsort.com, 201-930-8259
Ira Goodman, Manager, Technology Services
igoodman@syncsort.com, 201-930-8261
Michael Kuehn, Manager, Sales
mkuehn@syncsort.com, 201-930-8249

Backup Express is a high-performance, enterprise-wide backup and restore system, and is the simplest way to secure vast amounts of enterprise data quickly. Because it is distributed, Backup Express can back up and restore information to any device, whether a server is running UNIX, Windows or NetWare. *(SD/S,DM,SRM)*

Syntax Inc.
33650 6th Ave. S.
Federal Way, WA 98003

Syntegra
4201 Lexington Ave. N.
Arden Hills, MN 55126
www.syntegra.com

Syred Data Systems
272 Lanes Mill Rd.
Howell, NJ 07731
www.syred.com

Systran Corporation
4126 Linden Ave.
Dayton, OH 45432
www.systran.com

Tacitus Systems
210 Lake Dr. E., Suite 104
Cherry Hill, NJ 08002
www.tacitussystems.com

Tandberg Data *(SNIA)*
2685A Park Center Dr.
Simi Valley, CA 93065
www.tandberg.com

Tantia Technologies
100-4855 Riverbend Rd.
Boulder, CO 80301
www.tantiatech.com

Tatung Science & Technology
436 KatoTer.
Fremont, CA 94539
www.tsti.com

Tavata Software Corporation
7730 E. Belleview Ave., Suite A202
Greenwood Village, CO 80111
www.convergentdata.net
720-482-9559

Steve Wine, President
stevew@convergentdata.net, 720-482-9559
Brian Sobnasky, Chief Executive Officer
brians@convergentdata.net, 720-482-9559

Tavata Software Corporation is a software development company focused on delivering storage management software and solutions. Tavata Enterprise Storage Manager (TESM) software automates storage administration and management policies, helping to streamline information management. TESM software provides businesses with the necessary storage administration functions: diagnostics, event notification, reporting, asset management, provisioning. *(DM,SRM,OSM,S)*

TD Systems Corporation
100 Bearfoot Rd.
Northboro, MA 01532
www.tdsys.com

TEAC America Inc.
7733 Telegraph Rd.
Montebello, CA 90640
www.teac.com

Team ASA Inc.
6690 Mission Gorge Rd., #Q
San Diego, CA 92120
wwww.teamasa.com

Technical Cable Concepts
350 Lear Ave.
Costa Mesa, CA 92626
www.techcable.com

Technologic Software
4199 Campus Dr.
Irvine, CA 92612
www.technologic.com

Technology Exchange Inc.
1201 Lake Cook Rd., Suite E
Deerfield, IL 60015
www.tech-exchange.com
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steve@tech-exchange.com, 847-914-0620, x226
Dennis O'Malley, Vice President, Sales
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Technology Exchange is a full-service data storage solutions provider specializing in Storage Area Network (SAN) design and implementation. The company's technical excellence and its ability to provide advanced network design and first-rate technical support ensure its clients a complete storage solution that is customized according to a company's individual needs. *(SNI,DM,SRM,S)*

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425-709-2900

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SpaceNet™ is the first enterprise SRM solution that improves total cost of ownership and allows companies to realize a quick ROI through simplified management of data stored in a heterogeneous storage network. SpaceNet automates routine storage management tasks, identifies and manages networked storage devices from a central location, and is storage hardware and vendor independent.

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Peter Jones, Vice President, Sales & Marketing
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Vicom Systems is the premier provider of storage network management technology to leading OEM companies whose products must address the rapidly changing needs of the storage market. Vicom's storage management hardware and software enable OEMs to get to market faster with best-of-breed solutions that offer heterogeneous connectivity, outstanding performance and lower cost of ownership. *(SNI,DM,S)*

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Adaptec is the leader in providing IP storage connectivity for iSCSI SANs, NAS and Fibre Channel extension and routing devices. The company's storage networking group specializes in TCP/IP Offload technology and delivers iSCSI initiator and target adapters and ASICs, FCIP and FC-iSCSI ASICs, server NICs and Fibre Channel HBAs. *(SD/S,SNI)*

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www.agilent.com/view/storage
916-788-5780

Craig Stelzner, Manager, Storage Product
craig_stelzner@agilent.com, 916-788-5780

Agilent Technologies is a leading supplier of storage networking solutions, including 2 Gb/s Fibre Channel products for enterprise-class SANs. Agilent is also developing iSCSI solutions and was first to demonstrate iSCSI interoperability. Agilent Fibre Channel products include industry-leading Tachyon protocol chips, fiber-optic transceivers, and high-speed serializer/deserializer (SerDes) ICs. Visit www.agilent.com/view/storage. *(SD/S)*

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DataCore SOFTWARE

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Evaluator Group provides unbiased information and analysis of storage, SANs, NAS and related software. Subscription service provides access to its 3,500-page web-accessible database plus consulting, seminars, publications and white papers. *(S)*

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Inrange Technologies, the world leader in high-end scalable storage networking solutions, provides the building blocks to manage and expand large, complex storage networks simply, without geographic limitations. Inrange's core-to-edge-to-anywhere solutions solve the growing storage challenges facing today's IT organizations, while providing investment protection and a proven foundation for future growth. *(SNI,SRM,S)*

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www.intel.com/go/storage

Intel delivers the industry's broadest range of standards-based storage building blocks at multiple levels of integration. Intel is leading the technology transitions in RAID, iSCSI, Serial Disk interconnect, I/O Processors and Embedded Intel Architecture. *(SNI)*

Interconnect Solutions Inc. *(FCIA-E)*
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Old Isleworth, Middlesex, United Kingdom TW7 6RJ
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ISI (Interconnect Solutions Inc.) is a full-service, ISO-9001 registered manufacturer of cable assemblies and high-speed interconnects. With three strategic locations worldwide, ISI offers global support to OEMs, VARs, system integrators and resellers. ISI provides fast, friendly, knowledgeable service and competitively priced cables with the most solid designs in the industry. *(SD/S,SNI)*

Intermine Inc.
505 Montgomery St., Level 2
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Stuart Borton, Chief Executive Officer
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Scott McCallum, Chief Technology Officer
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Storage administrator overworked? Storage capacity underutilized? Quick to install and blindingly fast to run, Intermine FileCensus lets you discover, report, alert and ACT with respect to all your storage resources. Developed from the outset for heterogeneous networks, FileCensus is massively scalable, handles queries in real-time and does not impact servers during production hours. *(SRM)*

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Interphase is a performance-oriented, interoperability-conscious company offering storage networking adapters for Enterprise class applications. Interphase's PowerSAN™ Fibre Channel HBAs are designed for demanding Enterprise storage and high-bandwidth applications. Our SlotOptimizer™ adapters combine LAN and storage interface technologies into a single adapter, making more efficient use of precious PCI expansion slots. *(SD/S,SNI)*

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Invio™ Software provides enterprise software that automates information management processes across your networked storage environment and the applications it serves. With Invio, your IT organization can apply the power of automation to dramatically lower your total cost of storage ownership while consistently exceeding service level targets. *(DM, SRM)*

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I-TECH is a leading supplier of SCSI, Fibre Channel, and IP Storage testing technologies. I-TECH has recently introduced a multi-protocol analyzer supporting iSCSI protocol over Gigabit Ethernet and various storage and networking protocols over Fibre Channel, automated analysis of Fibre Channel test traces for SANmark™ qualification, and a multi-port 2-Gbps wire-speed SAN test solution. *(SD/S,SNI)*

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www.jni.com
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JNI Corporation is a leading manufacturer of connectivity products, including Fibre Channel HBAs, ASICs, high-availability SAN networking software, InfiniBand HCA Modules and related clustered server environments products. JNI HBAs are the de facto standard for Solaris-based SANs, and are used in enterprise data centers worldwide in multiple OS environments.(SD/S)

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650-210-7000

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Legato delivers worldwide enterprise-class software solutions and services that keep the world's business-critical information and applications available. Through direct sales and strategic partnerships and alliances, Legato delivers the advantage of business continuance through enterprise automation with information protection, application availability as well as content, message and storage management solutions. *(DM,SRM,S)*

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Kay Mushens, Manager, Marketing Services, EMEA
kaym@lsil.com, 44 0 1344 413302
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LSI Logic Storage Systems is the technology leader in high-performance, highly scalable storage and storage management platforms for the open enterprise. The company works with alliances, OEMs and channel partners to deliver robust storage solutions. And with over 20 years' experience, you'll find its technology inside much of the world's storage.
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System-Haus-Dresden
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Oslo, Norway
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The EVOLUTION of the IT LEADER

FIVE DECADES of innovation and chaos, politics and intrigue, technology and business have **MOLDED THE CIO** into a unique corporate executive. By Kathleen Melymuka

INFORMATION TECHNOLOGY is no longer the black box in the corporate basement, and CIOs are getting accustomed to their seats in the boardroom. With five decades of corporate experience to look back on, IT leaders are prepared to consider where technology and their roles are headed.

We asked four famous CIOs to help us examine the artifacts of the evolving IT culture and the changing function of the IT leader.

TABULATING MACHINES TO MAINFRAMES

THE 1960s

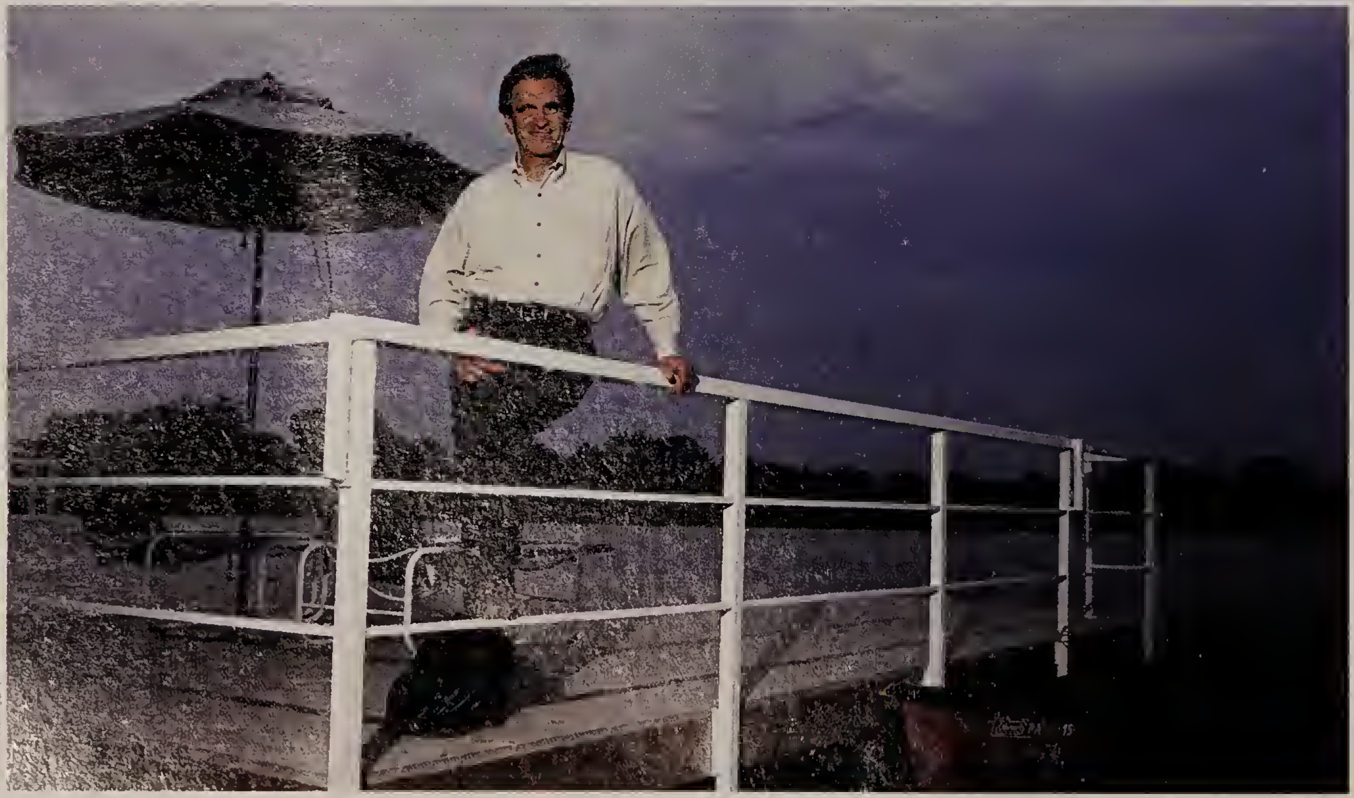
In the 1960s, companies were just growing out of tabulating machines and into computers. IT was all about data processing, or DP. The closest thing to a CIO was the director of DP. The skill set was strictly technical, and more often than not, the office was in the basement.

"We worked for the controller and did all the back-office stuff," says Charlie Feld. "Nobody in the company even knew where we were."

DP was focused on automating manual functions, especially in finance and transaction processing. It was characterized by the terms *centralized, glass house, controlled environment, mainframe computing* and *time sharing.*

"People often thought of this function as a utility for the corporation," recalls Ron Ponder. "It added little external or informational value."

While IT did the grunt work, it was the chief financial officer who got the glory, says Paul A. Strassmann. "The CIO worked for the CFO to install systems, which allowed the CFO to know all about cost, production and shipment," he says. "The CFO was the first to figure out that information technology gave him unbelievable power because he could know the results from the factories before the factory manager." And it was the CFO who controlled the mainframe that powered that information.



Charlie Feld

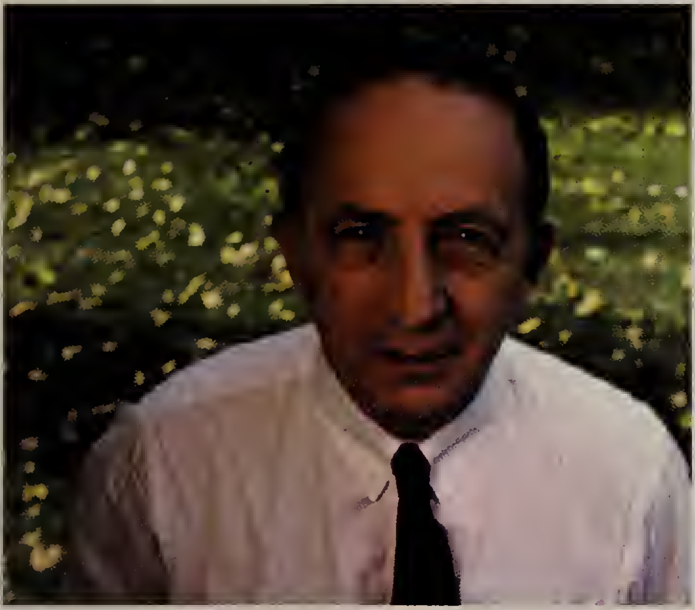
CURRENT TITLE
President of The Feld Group

FIRST CIO-LEVEL POSITION
CIO at Frito-Lay Inc., 1981

OTHER PAST POSITIONS
CIO at Burlington Northern Santa Fe Corp. and Delta Air Lines Inc.

> **"CIOs made some really bad choices because they didn't understand technology and jumped on the fads."**

35 YEARS OF IT LEADERSHIP



JERRY VALENTE

Paul A. Strassmann

CURRENT TITLE
Acting CIO at NASA

FIRST CIO-LEVEL POSITION
Director of corporate IS at General Foods, 1961

OTHER PAST POSITIONS
CIO at Kraft Foods Inc., Xerox Corp., and the U.S. Department of Defense

> **"Even a technical role is political, because information is power."**

MINISKIRTS AND MINICOMPUTERS

THE 1970s

In the 1970s, engineers and production and marketing people rebelled against the CFO's reign and bought minicomputers for their units. "Suddenly we had a devolution of power," Strassmann says.

DP didn't just work for accounting anymore. "All the function heads began to realize they could improve productivity by using technology," Feld says. Soon, IT was doing so much work for the business unit vice presidents that its name changed to management information systems, or MIS.

The information landscape was soon a mishmash of misaligned data. Simultaneously, a new generation of IT leaders with systems integration skills was acquiring power by implementing and controlling early networks of mainframes with dumb terminals. "They were clunky and bad," Strassmann recalls. But they were extending the reach of IT into the business.

The ability to improve the state of technology boosted the status of some MIS directors. At Xerox Corp., for example, Strassmann was charged by the president with unifying the corporate picture, and that required the authority to wrest back central control.

But the big bang of departmental computing couldn't be undone, and the functional silos that haunt IT to this day continued to develop. "From the mid '70s to the early '90s, everybody was working in functional silos," Feld says. Eventually, many of the silos were controlled by divisional CIOs, and corporate CIOs struggled to establish and maintain control over them.

ALL HELL BREAKS LOOSE

THE 1980s

"[In] comes the early '80s, and all hell breaks lose," Strassmann recalls. The microcomputer debuted in business, and everyone, from the secretarial pool to the mailroom, was smitten. Overnight, the bulk of many companies' computing capacity shifted from the central mainframe to scattered PCs. "The challenge then was to control the chaos," Strassmann says.

But amid the chaos, management began to see the potential of technology in the hands of business people and to look to IT for solutions to business problems. For example, Japanese auto sales were trouncing those of U.S. carmakers, and the answer seemed to be business process re-engineering powered by IT.

Amid these great expectations, the role of the IT leader changed dramatically. Upper management was suddenly looking for saviors, not geeks. "They want muscle, someone who can force change," Strassmann recalls. The chief information officer, or CIO, a newly coined term, was suddenly viewed as a valuable, high-level executive.

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In his first official job as CIO, Ralph Szygenda was information officer of the defense systems business at Texas Instruments Inc. "I was very different from the traditional CIO. I had come from running a business environment at TI. When I took over at defense systems, [they wanted] someone who knew technology but mostly who understood the business environment."

In this role, some CIOs wrought changes that are still studied in business schools today. At Frito-Lay Inc., for example, Feld built a mobile sales management system that revolutionized the food industry. And at FedEx Corp., Ponder's package-tracking system proved that information about a package is as important as its location.

But in many places, the pendulum swung too far toward business. "They were moving away from technical folks and bringing people in that didn't have technical skill but had leadership and business acumen," says Feld. "A lot of companies got into trouble, because CIOs made some really bad choices because they didn't understand technology and jumped on the fads."

Meanwhile, the decentralization of IT was crippling many companies' efforts. "You couldn't see from one end to another because the silos had 35 versions of what a customer is, and there was no one truth," Feld recalls.

POWER PLAY

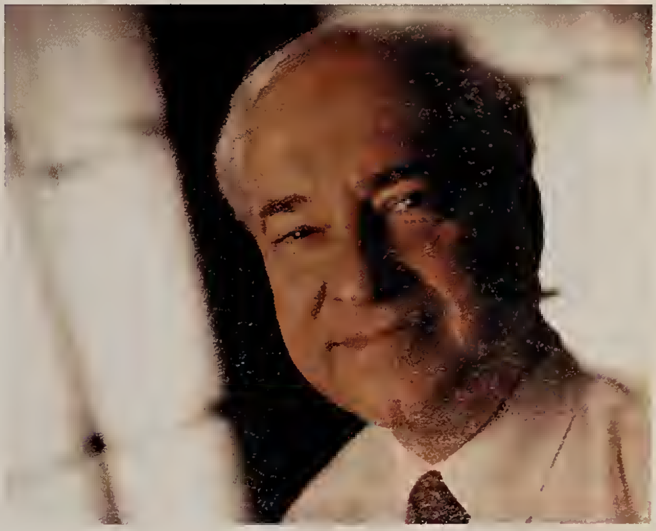
THE 1990s

By the '90s, many companies recognized that technology could boost profits, and the CIO had become a power position, often reporting to the CEO. But the push and pull of centralization and decentralization continued. Though there was still heavy reliance on the mainframe, the entrenchment of the PC brought on the era of client/server technology.

As companies built user-centric, client/server architectures, corporate investment in IT skyrocketed, reinforcing the role of the CIO as planner, architect and budget manager. "The corporation began to require a central reporting capacity for these costs," Ponder explains. "So while cost considerations pulled toward centralizing the function, the rollout of client/server pulled toward distributed."

"CIOs went from being technologists to being business guys with no technology," says Szygenda. "That didn't work because technology companies overwhelmed them and projects got in trouble. So they went back to the point where they still want someone that can integrate into the business and be a part of the CEO/CFO/CIO team — and technology is a given."

In the mid to late '90s, business recognized the value of the Internet. Once again, early Internet activities were local and decentralized, but the CIO was



DANIEL LEVIN

Ralph Szygenda

CURRENT TITLE
CIO at General Motors Corp.

FIRST CIO-LEVEL POSITION
CIO at Texas Instruments Inc., 1989

OTHER PAST POSITIONS
CIO at Bell Atlantic Corp. (now Verizon Communications)

> **"Everyone wants a technologist with a Harvard MBA."**

BOB BARRETT

Ron Ponder

CURRENT TITLE
CIO at WellPoint Health Networks Inc.

FIRST CIO-LEVEL POSITION
Director of data processing,
at Helena Chemical Co., late 1970s

OTHER PAST POSITIONS
CIO at FedEx Corp., Sprint Corp. and AT&T Corp.

> **"The CIO role behaved like an accordion – starting one way, then changing to another way."**

soon charged with leveraging costs and opportunities across the company. By decade's end, global CIOs were multiplying. "This was someone brought in to exert influence over the divisional CIOs, to bring order, to focus on grand strategic plans, strategic architecture, networking, competitors and partners, to create a consistent view of the customers across the enterprise," says Ponder, who played that role at AT&T in the '90s — as Szygenda did at General Motors Corp. during that time.

THE NEW MILLENNIUM

AFTER 2000 Except for technical skills, today's CIO bears almost no relation to the IT leader *Computerworld* wrote about in its early editions. The DP director of the 1960s was a supporting player; today's CIO is a senior executive. The '60s IT view was internal; today's CIO is aligned with the business' world view. The DP director was a geek among propeller heads; today's CIO speaks business to business leaders.

Throughout this evolution, there's been one constant behind every success and failure: "Technology has never been richer, and the quality of IT people has never been better," Feld says. "So why have some IT shops built systems that revolutionize their business while others build a mess? It's leadership." ◗

Melymuka is a Computerworld *contributing writer in Newbury, Mass. Contact her at kmelymuka@earthlink.net.*

Computerworld's Founder Looks Back on 35 Years

BY MARYFRAN JOHNSON

Back when computers were still a mystery to ordinary folks, the circa-1967 *Computerworld* reader was a high priest of automation, the sovereign ruler of back-office functions.

"If you were the computer specialist, you were a genius," recalls Patrick J. McGovern, chairman and founder of *Computerworld*'s parent company, International Data Group in Boston. "Business people didn't want to know what was going on back there. They just wanted to get the job done. And since they didn't understand it, senior managers were always a bit insecure about information technology, worried they were getting taken for a ride."

As *Computerworld*'s first editor and publisher, McGovern used his weekly newspaper the same way Theodore Roosevelt used the presidency — as a bully pulpit, to speak to, and advocate for, a freshly emerging class of information systems professionals. He called his subscribers "the computer community," and today there are 44 *Computerworlds* worldwide, with more than 1 million readers.

Today's reader may be in the same profession, but everything else has changed. IT professionals are now "active business strategists, people who know the technology but are more proactive about creating ways that companies should do business," McGovern says. "They manage supply chains, handle corporate assets and improve the processes that lead to business success."

During the past three decades, McGovern has seen dozens of computer publications rise and fall, each tied to the fleeting popularity of a specific technology or platform rather than to IT users' evolving needs. "Once a technology changes or becomes integrated, people don't need to read about it or learn as much about it, so these magazines disappear," he notes.

The IT industry in 1967 was built around selling complete turnkey systems, and a half-dozen companies ruled the computer world: Burroughs Corp., Sperry-Univac, NCR Corp., Control Data Corp., Honeywell Inc. and IBM. "Actually, at the time we started *Computerworld*, businesses were renting these systems, paying a monthly fee, and the manufacturer would provide a programmer to help develop a custom system. It was more like a facilities management service, and it was very prestigious to have that 'glass house' for your computers," McGovern says. "People used to put their computer center right on the first floor so people walking by could look in and say, 'Wow, what updated technology and farsighted management!' " Today, of course, security concerns would nix such a showy display of computer muscle.

When he considers the next big innovations in computing, McGovern sees the demand for wireless access and the arrival of broadband connectivity as twin trends that "will make the ubiquity of computers rapidly develop."

"Everyone will become a natural Internet user," he says, finding it easy to envision an era when people anywhere in the world will automatically turn to online sources for the latest news, scores, games, communication and interactive learning.

IT organizations are likely to increasingly shift to a service provider role, he adds, as CEOs look harder for cost controls, technologies keep commoditizing, and pay-as-you-go computing options proliferate in the market.

But whatever role technology plays in the future, McGovern sees his flagship publication continuing to expand its information services and keeping people in touch with one another and their ideas. "Sometimes the best expertise on any one thing is another peer, and I see *Computerworld* facilitating more of that contact," he says. "Ultimately, we all learn from each other." ◗

> **"People used to put their computer center right on the first floor so people walking by could look in and say, 'Wow, what updated technology and farsighted management!' "**

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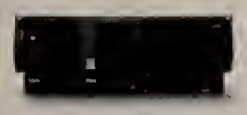

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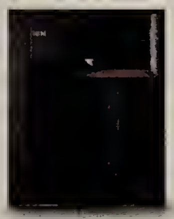

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[1] Requires Parallel Sysplex® environment. [2] Excludes scheduled downtime. [3] The IBM solution included two IBM UNIX server models 7026-M80 and 7026-H80 with IBM storage model 2105-F20 and IBM HACMP software. These server models are no longer available from IBM. All numbers and results reported are from customer sources. This customer example is intended as an illustration only. Costs and results obtained in other customer environments will vary depending, among other things, on individual customer configurations and conditions. IBM, the e-business logo, *e-business is the game. Play to win,* AIX, iSeries, pSeries, xSeries, zSeries and Parallel Sysplex are trademarks or registered trademarks of International Business Machines Corporation in the United States and/or other countries. Linux is a registered trademark of Linus Torvalds. Intel is a registered trademark of Intel Corporation or its subsidiaries in the United States and other countries. UNIX is a registered trademark of The Open Group. Other company, product and service names may be trademarks or service marks of others. © 2002 IBM Corporation. All rights reserved.

Technology TAKES FLIGHT

American Airlines' **SABRE RESERVATION SYSTEM** gave e-commerce wings and helped revolutionize air travel. By Robert L. Scheier

IT'S 1960. Gas costs about 30 cents a gallon. Only big business, government and academia own computers. The first phones to use buttons instead of a rotary dial are still three years away. And American Airlines Inc. and IBM are working on a revolutionary idea.

Their plan was to use computers to automate the process of reserving airline seats. Their brainchild was called Semi-Automatic Business Research Environment, or Sabre, and it pioneered e-commerce 30 years before the Web and helped make air travel accessible to the average person by tracking ever-growing numbers of flights and fares.

PIONEERING PROJECTS

Before Sabre, American used a system based on computer cards and teletypes to handle reservations. According to the Institute of Electrical and Electronics Engineers, processing a round-trip reservation between New York and Buffalo required the efforts of 12 people, at least 15 procedural steps and up to three hours.

By 1998, Sabre had evolved into a global distribution system (GDS) for travel information, reservations and transactions, connecting more than 30,000 travel agents and 3 million online customers with 400 airlines, 50 car-rental companies, 35,000 hotels and dozens of railways, tour companies, ferries and cruise lines. In 1964, the year Sabre was launched, there were 79 million airplane boardings in the U.S. Spurred in part by the ability of computers to track an explosion in fares, routes and flights, that number had risen to 560 million in 1998.

"[Online reservations] enabled airlines to grow rapidly to serve the expanding demand of the expanding business world," says Richard Eastman, president of The Eastman Group Inc., a Newport Beach, Calif.-based developer of travel industry software. It allowed the airlines to manage their inventory of seats faster and more accurately, with lower bookkeeping costs, he says. And through electronic settlement of ticket purchases, the reservation systems allowed airlines to get paid for tickets more quickly.

Now Web-based systems allow any customer with a PC to conduct sophisticated fare comparisons and, in some cases, link directly with travel providers without relying on a GDS. As a result, Sabre and its competitors, faced with dwindling demand for their expensive services, are selling off the GDS parts of their businesses and scrambling to update their technology.

At the start, American's Sabre, United Air Lines Inc.'s Apollo, TWA's WorldSpan and Amadeus (originally a partnership of European airlines) were internal "inventory" systems, owned by the airlines, installed only at airports and airline ticket offices and used to track each airline's seats, flights and other operational information.

The first version of Sabre was based on two IBM 7090 mainframes, which were among the first fully transistorized mainframes. They could handle 26,000 passenger reservation transactions per day and were linked by phone lines to American terminals in more than 50 cities.

Sabre was so new that it spurred the development of IBM's Transaction Processing Facility, an operating system that works with software to conduct a high volume of transactions in real time and that is still at the heart of many online systems.

By the late 1960s, Sabre and its competitors had become operational necessities, not luxuries. They cut costs by automating the seat reservation fare calculation process and could perform complex "yield management," juggling the price and availability of empty seats to maximize revenue for air carriers and enable frequent-flier programs. By the mid-1970s, airlines began marketing the systems to travel agents as a way to funnel more business to their flights, and by 1980, American reported that placing Sabre at travel agencies had generated $79 million in incremental revenue.

In the rough-and-tumble deregulated environment of the late 1970s and early 1980s, American began offering to "co-host" other airlines on Sabre, giving their flights preferential display on Sabre in return for a fee. In areas where American itself had no competing routes, this helped carriers such as Delta Air Lines Inc. and Western Airlines compete against flights pushed by United's Apollo system while making Sabre more attractive than Apollo for travel agents. Driven by demand for one-stop travel shopping, the systems placed in travel agencies worldwide evolved into GDSs, dwarfing the airline-specific "inventory" systems from which they sprang.

Eventually, the GDSs grew into mammoth businesses providing out-

JUNE 1967: The first issue of *Computerworld* is published. It's eight pages.↑

1967: Digital Equipment Corp. introduces the PDP-10.

1968: Gordon Moore and Robert Noyce found Integrated Electronics Corp., later known as Intel.

1968: Bob Dennard of IBM invents dynamic RAM, which soon completely replaces magnetic core memory.→

1968: The U.S. Patent Office issues the first patent for computer software to Martin Goetz.

1968: Mutinous computer HAL stars in the movie *2001: A Space Odyssey.*

SECURING wireless networks—

INTEL IT'S SUCCESSFUL JOURNEY

> "Pilot tests provide priceless feedback from users and help build a core skill in IT that can be used in deployment, while providing the data needed to select an infrastructure, architecture and design."
>
> —John Johnson, director and general manager for productivity, collaboration and security programs at Intel.

Mobile computing wasn't enough.

True, the rapid spread of low-cost, high-performance notebook PCs had reaped great savings and efficiencies for Intel Corporation's global army of knowledge workers. By 2001, roughly 77 percent of Intel's knowledge workers in 45 countries around the world were using mobile PCs, and the results were tangible.

But Intel IT, the company's own technology unit, was convinced that these mobile workers would be even more productive if linked via wireless connection to the vast resources of the firm's enterprise network. Faster decision-making, greater sales-force efficiency, and higher employee satisfaction—all of these benefits were possible if Intel IT could deliver wireless networks. And if Intel IT could prove this case internally among its knowledge workers, the benefits of wireless networking could be extended to Intel's broader global workforce.

Anytime, anywhere computing became the goal. Deploying wireless local-area networks (WLAN) became the means to achieve it. Yet standing between Intel IT and its goal was an imposing obstacle: developing and deploying a comprehensive security strategy amidst broad misperceptions that wireless communications are inherently insecure.

Pilot Tests: Validating the Approach to Security

Intel IT tackled the security issue head-on. The strategy: conduct a far-reaching series of WLAN pilot tests designed not just to help identify opportunities for increased worker productivity and savings, but also to pinpoint key security issues.

Intel IT wanted to prove that it could deploy wireless LANs to support anytime, anywhere computing, while simultaneously protecting the chip giant's intellectual properties and sensitive corporate data.

"Pilot tests provide priceless feedback from users and help build a core skill in IT that can be used in deployment, while providing the data needed to select an infrastructure, architecture and design," says John Johnson, director and general manager of productivity, collaboration and security programs at Intel.

Beginning in early 2001, Intel IT launched its pilot tests in earnest, addressing the technical aspects of security that stood between the group and its goal of providing global, mobile users with secure, radio access point links to Intel's 11Mbit/sec of bandwidth on IEEE 802.11b-compliant WLANs.

The Intel IT team quickly determined that the out-of-the-box Wireless Equivalent Protocol's (WEP) key creation scheme could only be used as one of several layers of security for their wireless pilots. The reason: It could allow an intruder with an antenna and a portable PC to tap into data transmissions from a parking lot or a nearby room.

"We realized that WEP was fairly soft, and we weren't comfortable using it alone," Johnson says. "Senior management expected a very secure wireless environment capable of meeting the anticipated needs of our employees. We were prepared not to move forward and put the effort on hold if we couldn't find a security plan that met our requirements."

Enter virtual private network (VPN) technology. Intel had already harnessed VPN to protect its wired remote access systems. Now Intel IT decided to make VPN serve double-duty to protect its wireless networks as well. Intel IT augmented WEP by equipping notebook computers with VPN client software, backed up by VPN gateways behind radio access points. VPN technology supports three additional methods for protecting data and communications, enabling Intel to encrypt all airborne data. "We've found VPN to be very secure and cost effective," Johnson says. "What we like about it is that we can use the same technology internally to secure our wireless environment and externally to enable secure remote connections via the public Internet."

"If I were asked by another IT manager whether to proceed with wireless LANs, my answer would be an emphatic *Yes!*"

—John Johnson, director and general manager for productivity, collaboration and security programs at Intel.

Intel IT also decided to employ wireless LAN sniffer devices that can constantly scan the networks for unsecured wireless LAN traffic. With a vigilant eye to the future of security, Intel IT is looking forward to upgrading to new 802.11i wireless standards (pending approval by the IEEE) to achieve even more advanced encryption and higher levels of user authentication.

By the end of the testing, Intel IT had met two huge goals: substantiating the ROI for the technology and validating its security blueprint.

Beyond answering inherent questions about security, Johnson says, the pilot tests helped Intel IT workers gain new confidence in wireless technologies. "IT groups should not be scared about getting into wireless," he says, "because we found that many wireline networking skills can be applied to wireless."

Broadscale Deployment: Intel Goes Live With WLAN

Buoyed by the results and lessons-learned from its WLAN pilots, Intel IT marched forward with its plans to broadly deploy secure wireless networks.

READY TO TAKE THE NEXT STEP?

Whether your next step is undertaking your own wireless LAN pilot or doing more research on wireless topics, you'll find these valuable how-to guides, case studies and white papers at:

www.intel.com/go/wireless

- Five Steps to Deploying a Wireless LAN
- Wireless 802.11 Security in a Corporate Environment
- Intel IT: Building the Foundation for Anytime, Anywhere Computing

source: Intel Corporation

At last check, Intel had more than 80 WLAN projects in various stages of implementation in the United States, Europe, and Asia. The company has been deploying WLANs primarily in warehouses, factories, corporate offices, sales offices and common areas.

And already Intel has reaped the rewards of global WLAN use. The numbers speak for themselves: an estimated productivity boost of 1.5 hours per day for each of the several thousand workers accessing roughly 80 wireless LANs in 18 countries. In response to the early success, Intel IT is now in the midst of a long-term deployment strategy designed to transition workers to access 802.11a WLANs that support a maximum data speed of 54Mbit/sec—with even greater security.

Asked to reflect on Intel's internal WLAN experience, Johnson is enthusiastic about Intel IT's successful deployment—that the group met its goal of securing anytime, anywhere computing for Intel's global workforce—and he's encouraged by the early, substantial returns from added mobility. "If I were asked by another IT manager whether to proceed with wireless LANs, my answer would be an emphatic *Yes!*" Johnson says. "The productivity gains we are seeing demonstrate that deploying wireless LANs to supplement our wired computing environment brings us a great deal of added value."•

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sourcing, software development and a host of other services to airlines and travel agencies, and many airlines spun off all or part of their GDS businesses. But their primary role was still as a toll road that every customer had to take to see fares and book travel.

WEB THREAT

The Web bypassed that GDS toll road, allowing a direct link between the customer and the airline for the first time. This new business environment, with its new processing needs and business models, also made it cost-effective for newer PC- and Web-based technologies to challenge the 40-year-old technology on which most GDSs still operate.

"The strategic uses of these systems is past," says Eastman, adding that the process of updating 1960s-era mainframe systems spells "the demise of the GDS as we have known them." It's no wonder the airlines are divesting themselves of their GDSs as rapidly as they can, he says.

Airlines still need computerized reservation and operational systems, although many are run by the GDS companies spun off by the airlines or by outsourcers such as Electronic Data Systems Corp. The GDSs themselves are busily updating their technology and business models to compete with companies trying to undercut their prices with newer, less-expensive Web-based technologies. The airlines, meanwhile, are busy fighting challenges such as the slump in demand following the Sept. 11 terrorist attacks and expensive union contracts — none of which was caused, or can be cured, by IT.

The success of GDSs makes it easy to forget that the major ones are basically inventory systems, built for a simpler time when the government authorized which cities an airline could serve and allowed only a few simple fare levels. Each new function — such as the ability to rapidly change routes and fares — meant expensive reprogramming in a low-level language requiring "four to 16 separate DOS-like commands simply to compare and price" multiple fares on a single route, says Eastman. Even so, the GDSs were reliable and robust enough that they weren't worth replacing — until the rise of the Web cut much of their pricing power.

Partly as a result of the need to keep patching older technology, the prices GDSs charged the airlines rose from about 50 cents per segment, or individual flight leg, to as much as $4.25 per segment now, says Eastman. The airlines, which paid the GDS to host their flight schedules, insisted that the GDSs adapt their basic, mainframe-based applications to work with newer generations of technology, such as minicomputers and PCs, rather than replace them outright, says Eastman. By the time the airlines realized "there were newer, faster [computing] tools out there," he says, it had become prohibitively expensive to re-create in newer technology 30 years of airline processes.

"They never had to get out of that system, as long as the supplier controlled the distribution process," says Eastman. As soon as customers could use the Web to shop for fares and seats themselves, he says, "their system broke down."

"A hotelier can load Sabre or Galileo with rates and instantly distribute them to participating travel agencies," says Philip Wolf, president and CEO of PhoCusWright Inc., a Sherman, Conn.-based travel industry consultancy. "But the hotelier can also distribute [room] inventory and pricing to Hotels.com or Expedia.com and, lo and behold, the same inventory is instantly available" to PCs all over the world. "For the first time, the [major] GDSs have viable competition," he says. Even Craig Murphy, Sabre's chief technology officer, acknowledges that "the Sabre global network isn't as important as it once was."

WHAT'S NEXT

The GDSs are so big, so well established and so critical that they won't disappear overnight. But they won't be owned by airlines or serve their original role as captive systems to distribute the airlines' "product" (seats on airplanes). They will instead be independent entities, serving multiple travel providers and multiple customers over the Web. Murphy argues that there's still a role for the Sabre GDS, using updated technology to provide a Web-based "intermediary" linking travel providers to travel users. He argues that attempts to "direct connect" customers to airlines, including Sabre's own GetThere business unit, will still link to the airlines through the GDSs.

After making the Sabre GDS and its associated businesses a separate unit in 1976, American's parent company sold its final stake in Sabre in 2000 so that Sabre could focus on providing technology services for the travel industry. But within a year, Sabre sold its IT outsourcing business and technology assets to EDS, shifting its focus to travel marketing, ticket distribution and reservation hosting.

DATELINE

1960: First Sabre system is installed.

1976: Sabre rolled out to travel agents and becomes business unit within American Airlines' parent company, AMR Corp.

JULY 1996: Sabre Holdings Corp. spun out of AMR as a separate business, but American keeps 83% ownership.

DECEMBER 2000: Sabre announces plan for $30 million overhaul of its computerized reservation systems to streamline handling of passenger data and expand electronic ticketing and payment capabilities.

MARCH 2001: Sabre Holdings sells its outsourcing business and technology assets to EDS for $3 billion and plans to focus on travel marketing, ticket distribution and reservation hosting.

MARCH 2002: Travelocity buys last-minute travel site Site59.com.

LARRY GOODE

1969: Arpanet, the precursor to the Internet, goes live.

1969: A U.S. antitrust suit forces IBM to unbundle its applications, languages and systems software.

1969: Edgar F. "Ted" Codd invents the relational database.

1969: Ken Thompson leads development of Unix at Bell Labs. →

1970: Digital ships its first 16-bit minicomputer, the PDP-11/20.

JULY 1971: Ray Tomlinson of BBN sends the first message from one network to another.

1971: Intel markets the 4004 CPU, the first microprocessor. →

Galileo International Inc. in Rosemont, Ill., which sprang from United's internal Apollo reservations system and later merged with several European distribution systems, was purchased last year by Cendant Corp., the owner of motel chains such as Ramada and Days Inn and car-rental company Avis Group Holdings Inc.

Madrid-based Amadeus Global Travel Distribution SA, owned by a combination of European airlines and public shareholders, operates e-Travel Inc., which provides travel services to corporate customers and travel suppliers. It also operates Vacation.com, an online network of travel agents.

The fourth major GDS, Atlanta-based WorldSpan, is still airline-owned but is up for sale, says Eastman.

RIVAL INVESTMENTS

Most of the GDSs, or the companies that own them, are hedging their bets by investing in competitors. "Sabre owns GetThere, which enables corporations to connect directly with an airline system and bypass the Sabre GDS," says Wolf. Similarly, he says, Amadeus is one of the investors in ITA Software Inc., whose pricing software is now used by the airline-owned Orbitz LLC travel site, which competes with the pricing systems run by the GDSs.

Eastman predicts that the GDSs will be supplanted in part by travel firms doing "online, real-time packaging" of airline seats along with hotel rooms and ground transportation, getting a higher markup than the individual airline or hotel could.

Even those that try to adapt face a rough road. WorldSpan, says Eastman, caught on early to the opportunity to be a "switch," routing traffic from travel Web sites to airlines' core reservation systems. But if Orbitz can "use cheaper, lower-cost Internet type technology . . . to offer direct purchase when you go directly into the airline inventory system, the value of the 'switch' goes away," says Eastman.

"WorldSpan's strategic initiative was great, but they failed to update their architecture" to reflect the needs of a demand-driven, Web-enabled industry, he says. "As a result, they are being bypassed."

The same is true for many of the GDSs, according to Eastman. "Technology, as demanded and expected by the new generation of knowledge-era humans, simply overwhelmed this ingenious solution of the late '50s and early '60s," he says. ◗

Scheier is a freelance writer in Boylston, Mass. Contact him at rscheier@charter.net.

CRIPPLED BY MAINFRAMES?

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A New SUPPLY CHAIN FORGED

WAL-MART put intelligence in its inventory and recognized the value of **SHARING DATA.**

By Amy Helen Johnson

LARRY GOODE

PIONEERING PROJECTS

"**BEING A SUPPLIER** to Wal-Mart is a two-edged sword," says Joseph R. Eckroth Jr., CIO at Mattel Inc. "They're a phenomenal channel but a tough customer. They demand excellence."

It's a lesson that the El Segundo, Calif.-based toy manufacturer and thousands of other suppliers learned as the world's largest retailer, Wal-Mart Stores Inc., built an inventory and supply chain management system that changed the face of business. By investing early and heavily in cutting-edge technology to identify and track sales on the individual item level, the Bentonville, Ark.-based retail giant made its IT infrastructure a key competitive advantage that has been studied and copied by companies around the world.

"We view Wal-Mart as the best supply chain operator of all time," says Pete Abell, retail research director at high-tech consultancy AMR Research Inc. in Boston.

Abell says he expects the company to remain in the vanguard. "Wal-Mart is evolving; they're not standing still," he says. The company is still pushing the limits of supply chain management, he says, searching for and supporting better technology that promises to make its IT infrastructure more efficient. Radio frequency identification (RFID) microchips, for example, may replace bar codes and security tags with a combination technology that costs less money.

SAM'S VISION

Wal-Mart founder Sam Walton first explored the idea of using computers to handle inventory in each store in the mid-1960s. But databases made only the analysis part easier; counting stock, a manual chore, was still a headache.

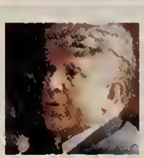
That headache didn't ease until the early 1980s, when retailers put into general use a way to electronically identify items. That was the genesis of the stock keeping unit, or SKU, and the standardized bar code.

The original idea for a machine-readable encoded identification symbol appeared in 1949, in a patent application submitted by Bernard Silver and Norman Woodland. In 1967, a rough system went into use at a supermarket in Cincinnati, using a circular symbol. In 1974, the first modern scanning system appeared — again, at a grocery store — reading the standardized, rectangular universal product code that's ubiquitous today.

It took a while for the majority of packaged goods

1972: The first electronic pocket calculator is developed by Texas Instruments Inc.

1972: Dennis Ritchie of AT&T Bell Labs develops the language C. Its predecessor was called B.



MAY 1973: Xerox PARC researcher Bob Metcalfe coins the term *Ethernet* in a memo. ←

JUNE 1974: A Marsh's Supermarket in Troy, Ohio, is the first to use bar-code scanning for groceries.

1975: Microsoft Corp. is founded by Bill Gates and Paul Allen. ↓

to be labeled with bar codes. At that point, in 1983, Wal-Mart invested in point-of-sale terminals, which simultaneously rang up sales and tracked inventory deductions. Four years later, a massive satellite system linked all of the stores to company headquarters, giving Wal-Mart's centralized IT department real-time inventory data.

Early on, Wal-Mart saw the value of sharing that data with suppliers, and it eventually moved that information online on its Retail Link Web site. Opening its sales and inventory databases to suppliers is what made Wal-Mart the powerhouse it is today, says Rena Granofsky, a senior partner at J.C. Williams Group Ltd., a Toronto-based retail consulting firm.

While its competition guarded sales information, Wal-Mart approached its suppliers as if they were partners, not adversaries, says Granofsky. By implementing a collaborative planning, forecasting and replenishment (CPFR) program, Wal-Mart began a just-in-time inventory program that reduced carrying costs for both the retailer and its suppliers.

"There's a lot less excess inventory in the supply chain because of it," says Granofsky.

POWER PARTNERS

That efficiency is a key factor in maintaining Wal-Mart's low-price leadership among retailers, says Abell. "Their margins can be far lower than other retailers' because they have such an efficient supply chain," he says. The company's cost of goods is 5% to 10% less than that of most of its competitors, Abell estimates.

Wal-Mart's success with supply chain management has inspired other retail companies, which are now playing catch-up, says Abell.

"Others are now just starting. They've all had inventory systems, but sharing the data with their partners hasn't been easy," he says.

Wal-Mart's influence has extended beyond the retail sector. Mattel's Eckroth says that he studied Wal-Mart's supply chain best practices when he worked at a manufacturing division of General Electric Co. "They're a benchmark company," he says.

One reason Wal-Mart is studied so closely is that it gets buy-in from its suppliers to an incredible degree. That's because its programs and practices benefit not just the retailer, but its partners as well, says Eckroth. CPFR, he says, has "blurred the lines between supplier and customer. You're both working to the same end: To sell as much product as possible without either of us having too much inventory."

Mattel learned a lot from working with Wal-Mart and is bringing those lessons to bear in its relationship with other channels, says Eckroth. "Getting the supply chain optimized inside of Mattel is only 50% of the equation," he says. "The other 50% is getting tightly linked with every one of our customers so that we're reacting as quickly as they're giving us data."

THE BAR CODE OF THE FUTURE

More sophisticated than their bar-code brethren, radio frequency identification systems, or smart tags, can produce more accurate inventory statistics and track a product's location down to the inch:

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Tight links, Eckroth says, will enable Mattel to tackle the next big business problem: increasing manufacturing efficiency.

"My ability to get information about the sales pace of a toy and either ramping up or shutting down manufacturing depends on my having data," he says. Having sales data on a daily or hourly basis is necessary to figure out on a micro level what is selling best where and tailoring manufacturing accordingly. The greatest efficiencies will appear when the kind of trusting, mutually beneficial relationship Mattel has with Wal-Mart is duplicated with the rest of the manufacturer's retail outlets.

"Having that data on a global basis from every one of my customers allows me to optimize the sales of my products and the fill rates of my customers," Eckroth says. "The theme for the future is that at the end of the day, there can be a symbiotic relationship between companies."

THE 21ST CENTURY INVENTORY SYSTEM

At Wal-Mart, CIO Kevin Turner and his staff are evaluating ways to apply wireless technology in stores. The company is also testing emerging RFID smart-tag systems, which might replace bar codes with a more efficient product-tracking mechanism.

Retailers like Wal-Mart have gotten very good at keeping stores optimally stocked. The next step, says Abell, is improved inventory analysis software that tailors the mix of goods on store shelves based on their individual sales patterns and the total cost of goods, including often-hidden factors like transportation fees, package size and inventory carrying costs.

Such demand chain management systems are in use in Europe and Japan and are making their first inroads in the U.S., Abell says. Some of the vendors that provide this technology are SAF AG in Tagerwilen, Germany, DCM Solutions Inc. in Irving, Texas, and Industri-Matematik International Corp. in Stockholm.

But don't count out the current leaders that offer analytics software, says Granofsky, such as Retail Technologies International Inc. in Sacramento, Calif., and Retek Inc. in Minneapolis.

"These are the major players, and they'll continue to be so," she says.

Cathy Hotka, vice president of IT at the National Retail Federation in Washington, sees in-store kiosks returning to the consumer scene. Once little more than advertising vehicles, kiosks are evolving into something shoppers will likely find useful, says Hotka. With them, customers can check the inventory of an item to find out if it's available and at which locations, get an exact resupply date for out-of-stock merchandise, check product specifications before buying, or order products and have them shipped to their homes.

Based on Wal-Mart's profitable approach of creating supplier partnerships, cooperation between retailers and suppliers is likely to become the de facto business strategy in the future. That's because it works, says Eckroth.

"We've learned that if we listen to [Wal-Mart], take their initiatives seriously and align our strategies with making them successful, we both can succeed," he says. ◗

Johnson is a Computerworld *contributing writer in Seattle. Contact her at amyhelen@pobox.com.*

DATELINE

1962: Wal-Mart opens its first store.

1979: The retailer switches to a computerized inventory system that tracks individual items.

1983: With bar codes printed on most goods, Wal-Mart introduces checkout scanners in all its stores. They update inventory numbers for individual items at the point of sale and enable headquarters to more easily aggregate sales and inventory data at its centralized IT department.

1987: Wal-Mart completes a two-year satellite communications network installation that sends data from all stores to headquarters, providing real-time inventory data.

1990: The retailer implements a collaborative planning, forecasting and replenishment process that brings suppliers and distributors together to build a combined planning calendar. Forecast accuracy increases.

JULY 1996: Wal-Mart launches its e-commerce Web site.

JANUARY 1975: The Altair 8800, the first PC, makes the cover of *Popular Electronics.*

1976: Steve Jobs and Steve Wozniak form Apple Computer Inc.

1976: Honeywell ships Multics Relational Data Store, the first commercial relational database.

APRIL 1977: Dennis C. Hayes begins selling the first modem designed for desktop computers.

SEPTEMBER 1977: RadioShack sells 10,000 TRS-80 microcomputers in their first month on the market.

1978: Digital ships its first VAX-11/780.

1978: Dan Bricklin and Bob Frankston develop VisiCalc, the first electronic spreadsheet.

1979: Oracle Corp. introduces the first commercial SQL relational database management system.

PIONEERING PROJECTS

The Web's BEST-SELLER

AMAZON.COM drew consumers to the Web in droves and forever changed inventory control. By Stacy Collett

LARRY GOODE

IT SEEMS COMICAL NOW, but less than seven years ago, the staff at online retail giant Amazon.com Inc. processed credit cards by taking a customer's order on one computer, putting the information on a floppy disk and walking it over to a separate computer. They called it the "sneaker net," and it was done to make wary first-time customers feel comfortable that hackers wouldn't steal their credit card information.

Those days are long gone. But the Seattle-based e-commerce giant, which reported sales of $3 billion in 2001, hasn't changed its relentless pursuit of customer satisfaction or its focus on using technology to improve the customer experience. Back in 1995, there were no off-the-shelf packages for online shopping carts, or Secure Sockets Layer for credit card transactions. Amazon created most of its early applications either from scratch or by creatively weaving together existing software, paving the way for the e-commerce era.

Shel Kaphan, Amazon's first programmer in 1994, says the start-up years were an exciting time. "A lot of things were tried. Many of them didn't work out," he recalls, "and the ones that persist are generally the ones that people have found most useful."

A HISTORY OF FIRSTS

Today, Amazon's e-business prowess and technology innovations are the industry standard not only for business-to-consumer transactions, but in the business-to-business world as well, says Laurie Orlov, an analyst at Forrester Research Inc. in Cambridge, Mass. The company remains one of the few successful online "pure-play" retailers.

"Amazon.com was in many respects the birth of sustainable consumer-based commerce transacted across virtual electronic networks," says Mario Morino, founder and chairman of the Reston, Va.-based Morino Institute, a nonprofit organization created in 1994 to explore the New Economy and the impact of the Internet on society. "Many forget that electronic business interaction has been a reality since the mid-'70s, perhaps earlier, when close partners passed proprietary trading information to aid in business process management. However, [consumer electronic business interaction] had no such legacy to build upon prior to Amazon."

Amazon.com was also the first commercial Web site to use "collaborative filtering" technologies to analyze customer purchases and suggest other books that people with similar purchase histories have bought. Its one-click ordering technology also set

1980: AT&T begins licensing Unix to computer vendors for resale on workstations and servers.

1980: Comdisco gets into the disaster recovery business.

1980: Bjarne Stroustrup at AT&T Bell Labs develops C with Classes, which evolves into C++.↖

AUGUST 1981: IBM announces its Personal Computer.↓

1982: Novell demonstrates the first PC LAN, which will eventually become NetWare.

1982: The first computer virus "in the wild" infects Apple II computers.

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new e-commerce standards for online purchases.

"There was always a vision to make the service as useful as possible to each user and to take advantage of the ability of the computer to help analyze a lot of data to show people things they were most likely to be interested in," Kaphan says.

Because Amazon was breaking new cyberground, it had to develop most of its own technology to take orders online, coordinate distribution and handle huge volumes of e-mail. Paul Barton-Davis, another early Amazon programmer, says the company's most significant conceptual idea was its "almost-in-time" inventory control applications, as opposed to just-in-time inventories, where companies strive to always have just the right amount of stock on hand.

"We used to joke that our motto could be, 'We don't have it in stock, but we can get it really quickly if you'd like,' " Barton-Davis says. At the time, no inventory control software existed that could handle that business model. Although Amazon now keeps thousands of items in stock at all times, "almost-in-time inventory control is still a significant departure," he says.

Today, Amazon continues to evolve its IT strategy by expanding its technology alliances and partnering with other retailers that are thirsty for Amazon's ordering, distribution and customer service capabilities.

"When the history of e-commerce is written, people will credit Amazon as being the most important driving force in the acceptance of e-commerce," says Robert Spector, author of *Amazon: Get Big Fast* (HarperCollins, 2002).

DATELINE

1994: Jeff Bezos founds Amazon.com and hires programmer Shel Kaphan.

JULY 1995: Amazon launches with a homegrown database and applications.

MAY 1997: Amazon.com goes public.

JANUARY 2000: Amazon goes on a nine-month, $200 million shopping spree for new applications, databases and support.

MAY 2000: Amazon signs a deal with HP to supply servers, storage and IT services. RISC servers are replaced with HP machines running Linux.

SEPTEMBER 2000: Amazon announces its first deal to provide Web operations for another company, Toys R Us.

APRIL 2001: Amazon announces a deal to run the Web operations of bookseller Borders. This time the company will also own the inventory.

DECEMBER 2001: Amazon posts its first profit since going public.

THE PROLOGUE

When Jeff Bezos founded Amazon in 1994, the company's technology empire existed on little more than a few workstations from Sun Microsystems Inc. Programmers Kaphan and Barton-Davis set to work writing code to deliver Web pages, compiling a database of 1 million book titles with the help of databases from the Library of Congress and Books in Print. In July 1995, Amazon opened its Web site for business.

"Amazon was dependent on commercial and free database systems, as well as HTTP server software from commercial and free sources. Many of the programming tools were free software," Kaphan says.

By 1997, the massive million-record database was running on Digital Alpha servers. Applications were still being custom-developed. But by early 2000, Amazon's data management needs grew to encompass 100 separate database "instances" running on Compaq/Digital, Hewlett-Packard Co. and Sun servers and supporting terabytes of data. The company's IT team realized that it was time to raise its IT infrastructure to a corporate-class level.

Over the next nine months, Amazon would go on an IT shopping spree and spend $200 million, or 11% of its net sales, on new applications from E.piphany Inc., HP, Manugistics Group Inc. and Oracle Corp. It also struck deals with Excelon Corp. for business-to-business integration software and with SAS Institute Inc. for data mining and analysis applications.

But Amazon's most important applications — its personalization and customer contact software — were largely written by the company's own programmers in the late 1990s. The personalization capability recognizes when a visitor returns to the company's site and, based on that person's previous purchases, recommends products. With this technology, Amazon has one of the world's largest business intelligence applications.

THE BIRTH OF CONSUMER WEB COMMERCE

Venture capitalist Mario Morino talks with *Computerworld* about the role Amazon.com has played in the legacy of e-commerce:

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As part of Amazon's IT transformation, in May 2000 the company signed a deal to have HP supply it with servers, storage and IT services, all of which helped with scalability and the support of its distribution and supply chain management processes. RISC servers from Sun and Compaq were replaced with HP machines running Linux. "They were one of the early adopters of Oracle9i. They started bringing new Linux in the very early stages. In that respect, they were definitely innovative in trying out new products and exploiting the latest technologies," says Albert Pang, an analyst at IDC in Framingham, Mass.

By October 2001, with most of the new IT infrastructure in place, Amazon had spent just $54 million on IT systems, development and consulting for the quarter, 24% less than in the same quarter a year earlier. The company said in a Securities and Exchange Commission filing that it was able to save money by shifting its software to run on a Linux platform. Coincidentally, in the following quarter of 2001, it posted its first profit since going public in May 1997.

EXPLOSIVE GROWTH BEGINS

From 1997 to 2000, Amazon continued to gain in popularity and sales, but profits remained elusive. With the e-commerce bubble about to burst at the end of 2000 and profits still in the red, Amazon struck partnerships with brick-and-mortar stores to leverage its technology expertise. That year, Amazon formed a platform service group and became an outsourcer of technology and customer service. Retailers such as Toys R Us Inc. began using Amazon's technology and distribution platform for their online sales. Later, Amazon announced similar deals with Borders Group Inc., Circuit City Stores Inc. and others.

"Amazon gives companies like ours options, in terms of how we rationalize our IT investment," says Bob Edington, director of retail convergence services at Borders, an Ann Arbor, Mich.-based bookseller. Borders had reservations about surrendering its Web site to an outsourcer, since it would be just the second client for Amazon, and it was worried about customer service. But, Edington says, "Amazon has gotten where it is because they do it so well."

Just as Borders realized that it should focus on selling books instead of building e-commerce, Amazon may have more leverage in the software and fulfillment business than in peddling books, videos and DVDs. Some observers say Amazon's technology may hold the key to its future.

Today, a handful of new technologies offer personalization and simplified online purchasing, but none matches the total package Amazon has built combining technology and an enormous volume of data. "Other companies would be able to match the technology, but the competitive advantage is the sheer amount of customer data in their warehouse. You can't do that overnight," says Pang. ▶

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1982: Rod Canion, Jim Harris and Bill Murto found Compaq Computer Corp. to make IBM-compatible PCs.

JANUARY 1982: The U.S. government drops its 13-year-old antitrust case against IBM.

FEBRUARY 1982: Sun Microsystems is founded to build low-cost Unix workstations.

DECEMBER 1982: *Time* magazine declares the computer "Machine of the Year." →

1983: RadioShack offers a book-size computer, the Model 100 – the first laptop.

FEBRUARY 1984: The first printed mention of Y2k is published in *Computerworld.*

MAY 1984: With $1,000, Michael Dell starts Dell Computer Corp. in his college dorm room. ↓

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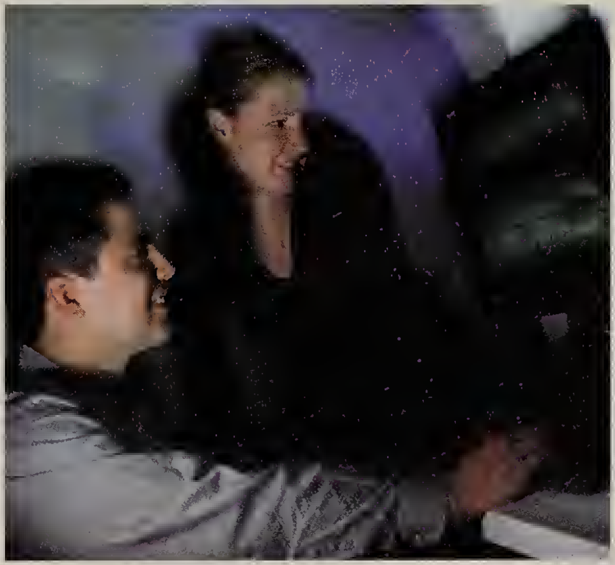

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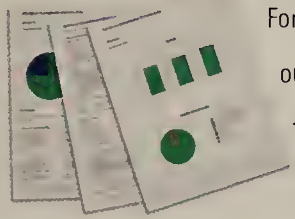

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Securing CREDIT DATA

They didn't invent any technology, but **MASTERCARD, VISA** and **AMERICAN EXPRESS** have been pioneering power users, building fortresses of secured customer data. By Jaikumar Vijayan

PIONEERING INDUSTRIES

NINE MILLION MILES of communication lines, 85TB of data and a system architecture capable of processing more transactions in one hour than all the stock exchanges in the world handle in one day. That's only part of what it takes Visa International Inc. to deliver on its global promise to be "everywhere you want to be."

There are also fortresslike data centers, massive storage arrays, multiple layers of redundancy and fully mirrored operations. "I'd be surprised if there are more than one or two other companies where the brand promise has been fulfilled to such an extent by the use of information technology," says Visa CIO Scott Thompson. "It's just a very profound statement on how important technology has been to Visa and to our brand."

His point is well taken. Few industries have benefited more from — or taken better advantage of — technology than credit card companies, including Visa, MasterCard International Inc. and American Express Co.

A quick look at how credit card companies authorize, clear and settle transactions shows just how far technology has moved the industry since Diners Club International Ltd. and New York-based Amex introduced the first major universal credit cards in 1958.

A NEW AGE

When consumers first began widely using credit cards in the mid- to late-1970s, they had to wait patiently while the merchant rang up the credit card company, read the account number and got an authorization code clearing the purchase.

For small purchases, the merchant would thumb through books containing lists of bad cards. And transactions were cleared using paper receipts and card imprints.

The primary technological challenge in the early days was to move everything from an off-line world to a real-time electronic authorization and settlement system, says Rob Reeg, senior vice president of systems development at Purchase, N.Y.-based MasterCard. And that meant building a network connecting merchants, their banks and credit card-issuing banks. It meant having some kind of point-of-sale technology capable of capturing credit card information, zapping it over the network and getting the needed authorization back to the merchant.

"For its time, it was a very complex undertaking, in terms of the business relationships that had to be supported through the use of technology," says Chuck Hieronymi, a senior vice president at MasterCard's Global Technology Operations.

Today, much of the processing happens in milliseconds. MasterCard's Banknet and Visa's VisaNet are among the world's largest communications networks. VisaNet is capable of processing up to $60 million in transactions per hour, or more than $1 trillion in global payments annually.

In terms of transaction speeds, Foster City, Calif.-based Visa's clearing system can fly through as many as 4,000 authorization messages per second, or more than 100 billion transactions annually. Operations that used to take nearly a whole minute in the mid-1970s are processed by credit card networks in less than two seconds, on average.

The staggering transaction volumes, lightning-fast processing times, dead-on accuracy and nonstop reliability of these networks are a far cry from the early days, says Jim Van Dyke, an analyst at Javelin Strategy and Research Inc. in Pleasanton, Calif.

"What goes on behind the scenes today is simply amazing," he says.

BIG REQUIREMENTS

For instance, the use of magnetic stripe technology, available since the early 1970s, for storing customer account information, and the growing

Continued on page 48

1984: Hewlett-Packard launches the first successful laser printer, the LaserJet.↑

1985: Aldus introduces PageMaker, launching the desktop publishing industry.

1985: First "business intelligence" computer system is designed, for Procter & Gamble.

1986: Merrill Lynch's DuWayne Peterson becomes first million-dollar CIO.↙

1986: Burroughs Corp. merges with Sperry Corp. to create Unisys Corp.

1986: The U.S. Congress passes the Computer Fraud and Abuse Act to deal with computer trespasses.

JANUARY 1987: Alabama bans PCs from its legislative chamber because of the annoying "tap, tap, tap."

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35 YEARS OF IT LEADERSHIP

Continued from page 46

use of electronic point-of-sale terminals starting in the early 1980s, revolutionized the manner in which credit cards were accepted and authorized.

Similarly, credit card companies have been good at taking advantage of bigger, faster and cooler mainframes, as well as Unix servers, IP-based networks, intelligent routing technologies, storage networking and nonstop, fault-tolerant computers to provide much of the raw horsepower needed to support their networks. VisaNet, for instance, comprises 25 large mainframes and more than 230 midrange systems running more than 50 million lines of code — 2 million to 3 million lines of which are modified annually.

"Over the years, some of the most stringent requirements for performance and reliability have come from credit card companies," says Avivah Litan, an analyst at Gartner Inc. in Stamford, Conn.

In terms of business continuity and disaster recovery — areas that have come to the forefront since last September's terrorist attacks — "credit card companies have probably the best facilities after the Department of Defense," Litan says.

ZERO DOWNTIME

Both MasterCard and Visa have data centers that are fortified against a variety of natural and man-made disasters. Everything from power grids and standby power supplies to individual systems, processes, networks and entire data centers are backed up — sometimes multiple times, not just at domestic locations but at international ones as well.

As a result of such measures, Visa has had a total of eight minutes of unplanned downtime in the past five years.

"It takes a very special talent, skill and mind-set to do that," says Thompson, whose goal is to push the eight minutes of downtime down to zero, because "there really is not a single moment any day when we can take our systems down."

Credit card companies have also been especially adept at using technology to detect and manage fraud, says Javelin Strategy's Van Dyke.

Technologies such as neural networking, artificial intelligence and pattern recognition have helped to dramatically reduce the fraud that was once almost considered the cost of doing business at these companies, Litan says.

Credit card fraud today accounts for less than 0.06% of all transactions — 15 to 18 times lower than the rate was about 10 years ago, says Litan.

The ubiquity of automated teller machines, magnetic stripes and tamper-resistant signature strips have all been driven by credit card companies. Similarly, fault-tolerant computing technologies and standards relating to data exchange, consumer-risk rating and fraud detection have benefited enormously from credit card companies, analysts say.

LARRY GOODE

EVER-EVOLVING

Going forward, expect to see more of the same kind of innovation — but on a much broader scale.

For one thing, credit card use is booming. In 2001, credit and debit cards represented 26.4% of all consumer payments in the U.S., up from 18.5% in 1994, according to Visa's estimates. During the same period, the use of bank checks for making payments dropped below 50% from 57%, while cash payments slipped from 18.6% to 16.4%.

The growth of the Internet and the use of wireless technologies for credit card and bank transactions have introduced new "layers of complexity," even as they have opened up new opportunities, Thompson says.

"It is an evolution in how and where payment transactions can occur," says MasterCard's Reeg.

As a result, networks such as VisaNet and Banknet are being upgraded and adapted to support a wide range of electronic payments through the Internet and various mobile devices.

Expect to see credit card companies move into the "people-to-people" online payment market, where individuals pay each other directly for purchases made — for instance, at an online auction, Van Dyke says. Telecommunications companies and upstarts such as PayPal Inc. in Mountain View, Calif., have taken an early lead in this potentially huge market, he says.

"I can imagine a scenario not too far from now where, from a technology perspective, we are going to have to double the capacity and the number of transactions per second supported by our network," Thompson says. ◗

DATELINE

1958 American Express introduces the first major universal credit cards.

1979 Visa begins using electronic terminals at point of sale.

1981 MasterCard introduces the first gold bank card program.

1983 Visa launches the automated teller machine network. MasterCard becomes the first to use the laser hologram as an antifraud device.

1989 MasterCard introduces the first bank card with a tamper-resistant signature panel.

1993 Visa launches a neural network to combat fraud.

1997 Visa launches the first secure electronic transmission.

2000 MasterCard becomes the first in the industry to establish a U.S. rule of no liability for the consumer from the unauthorized use of payment cards.

TRANSACTION NETWORK TUNE-UP

How Visa and MasterCard are upgrading their processing networks to meet the demands of the future:

QuickLink 32642
www.computerworld.com

APRIL 1987: IBM announces OS/2.

JUNE 1987: College dropout Bill Gates, 31, becomes the youngest billionaire in the U.S.

OCTOBER 1987: Computer-driven "program trading" causes the stock market to crash. The Dow drops 500 points.

NOVEMBER 1987: Borland's Quattro spreadsheet triggers a legal battle over software "look and feel."

OCTOBER 1988: Steve Jobs' Next Inc. unveils a $6,500 computer to be sold only to academia.

1988: IBM debuts the AS/400 midrange computer, code-named Silverlake. →

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Signed, Sealed and DELIVERED

FEDEX and **UPS** have pushed the technology envelope with an obsession with information and a fierce game of one-upmanship. By Steve Ulfelder

NOT A TOY AEROPLANE!

LARRY GOODE

"INFORMATION ABOUT THE PACKAGE will soon be just as important as the delivery of that package."

On any list of insightful statements about the impact of technology during the past 35 years, that one belongs near the top.

FedEx Corp. founder and CEO Frederick W. Smith made that statement in 1979, succinctly predicting the next quarter-century of IT innovation. The statement has become so totemic that it's repeated — in generic form, to be sure, with no credit given to its original utterer — in the corporate literature of rival United Parcel Service Inc.

The competition between Memphis-based FedEx and Atlanta-based UPS is gentlemanly compared with other famous rivalries (Ford and GM, or Coke and Pepsi, for example) but fierce nonetheless. And due to the straightforward nature of putting a box on a truck or a plane and making sure it gets where it's supposed to go, that competition has come to revolve around information — which, in turn, has led to an enviable record of IT innovation by both companies.

This innovation has led to advances in other industries as well. For example, the shipping giants' obsession with information about packages has been extended to manufacturing, where supply chain data has become more granular than ever. And in 1996, UPS and FedEx each vowed to move their businesses to the Web — a promise that they've largely kept.

PIONEERING INDUSTRIES

Such innovation guarantees that the shipping companies' IT organizations are closely watched by other industries, according to Jeff Woods, an analyst at Stamford, Conn.-based Gartner Inc. "These are best-practice leaders," he says. "These are the companies showing CIOs where we're going next."

THE EARLY SEEDS OF INNOVATION

FedEx's origins as a maverick company are well known. It has entered 20th century business lore that while attending Yale University in the 1960s, Smith wrote up his overnight-delivery concept in a paper and received a C grade. Despite the lukewarm reception to his idea, Smith forged ahead, founding FedEx in 1971.

In 1978, the company put voice-only radios in its trucks. Two years later, FedEx launched a proprietary and then-revolutionary wireless data network called Digitally Assisted Dispatch System (DADS).

The system increased efficiency by eliminating radio chatter; dispatchers were now able to use text

Continued on page 52

NOVEMBER 1988: Robert Morris releases his "worm" program, which cripples the Internet for days.

MARCH 1989: CERN physicists Tim Berners-Lee (left) and Robert Cailliau propose the World Wide Web.←

1990: Thomas H. Davenport, Michael Hammer and James Champy promote "business process re-engineering."

SEPTEMBER 1990: IBM and Microsoft split on OS/2 and Windows development.

1991: Philip Zimmermann releases Pretty Good Privacy, a free public-key encryption system.

OCTOBER 1991: Linus Torvalds releases the first Linux kernel.↖

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35 YEARS OF IT LEADERSHIP

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messages to change drivers' routes and pickup requests. DADS, which is still in use, led to a 30% increase in couriers' productivity — the first day it was used.

DADS has always been a private network, but that's changing. Winn Stephenson, senior vice president of technology systems at FedEx Services, says that in the U.S., FedEx is moving toward a hybrid network that uses public General Packet Radio Services (GPRS) technology in metropolitan areas and a private network structure in rural and remote ones. The reason, Stephenson says, is that GPRS is reasonably priced and offers the capabilities FedEx needs.

In 1986, the company adopted its present generation of wireless handhelds, called SuperTrackers. These devices capture package data via a bar-code scan. When couriers return to their trucks, they insert the SuperTracker in their DADS unit, and the information is downloaded to the company's proprietary package-tracking system, the Customer Oriented Service and Management Operating System, or COSMOS.

FedEx's technology leadership stems in part from the fact that it has always offered incentives to employees for innovation. "Smith offers payments up to $25,000 for suggestions to improve productivity," says Howard Rothman, author of *50 Companies that Changed the World* (Career Press, 2001) in which FedEx is profiled.

For example, in 1989, when FedEx bought out international shipping company Flying Tigers, a Flying Tigers pilot who doubled as a programmer wrote software that allowed the human resources department to merge the seniority profiles of pilots from both outfits. The pilot/programmer was rewarded handsomely, and the software is still in use.

Urged on by Smith, FedEx has been an early adopter — and, in many cases, a pioneer — of technologies such as videoconferencing, wireless connectivity and bar codes.

But companies that value innovation must put up with its bucktoothed cousin: failure.

Laurie A. Tucker has been at FedEx since 1979 in a host of positions and is now senior vice president of global marketing. She recalls a 1996 effort that never took off: a Web publishing operation. It was intended to help enterprises set up Web sites using FedEx-designed templates. It didn't have a prayer. "People wondered what this transportation company was doing in the publishing business," Tucker says. "But nobody got fired for that. We don't punish people for taking risks."

TWO ROADS TO SUCCESS

Because of FedEx's impressive and well-publicized record on IT innovation, it's tempting to think of 94-year-old UPS as a plodder that tries hard but always lags by a step. "UPS is a much more structured environment," says Gerald McNerney, a senior analyst at Boston-based AMR Research Inc. "A lot of the [top executives] there came out of the military, and that shows."

Even UPS CIO Ken Lacy concedes that the company's approach to IT is "very methodical," in keeping with its button-down management style. "That's just how we approach governance," he says. However, analysts say UPS has played an excellent game of catch-up and pulled even with its rival, which is no mean feat.

In contrast with FedEx's freewheeling, let's-give-it-a-shot style, UPS has four standing IT committees devoted to finance, governance, strategy and new technologies. The committees are composed of business executives and technologists who report to Lacy and steer UPS's efforts.

That may seem unwieldy, but analysts say the system has allowed UPS to spend not just massively — "We've invested $14 billion-plus since the mid-1980s to build integrated global networks," Lacy says — but also wisely, never decoupling its IT spending from business goals.

In 1990, UPS introduced its own handheld, called the Delivery Information Acquisition Device (DIAD). The devices are still in use, having been upgraded several times. In its present incarnation, the DIAD both captures and transmits delivery data in real time (UPS is happy to point out that it beat FedEx to the punch on this feature), serves as a cell phone and has a host of new ease-of-use and maintainability features. Today's DIAD runs on PSOS, an embedded operating system; however, the next-generation devices will be based on Windows CE.

UPS also offers an innovative set of application programming interfaces that let companies create their own hooks into functions such as package and signature tracking. Called UPS OnLine Tools, they act as the server side of an Internet client/server application. Customers can set their e-commerce applications to act as clients to the UPS OnLine Tools while simultaneously acting as a server to end users' browsers. Analysts say the platform-independent tools offer convenience, as well as a virtual lock-in to UPS services.

NEXT UP: WIRELESS AND OUTSOURCING

And what of the future? With the two shipping giants "growing more and more alike in corporate culture," says Gartner's Woods, it's no surprise that both are rolling out new wireless devices for their couriers. FedEx CIO Robert B. Carter becomes animated when discussing his company's tool, called PowerPad. It will use Bluetooth technology to automate some repetitive tasks and work on 2.5G and 3G wireless networks.

Carter says the company's other IT focus for the near future is "better integrating systems across divisions." In addition to its trademark FedEx Express service, the company is a large player in ground, palletized-freight and international shipping. Carter's goal is to funnel package data from all these operations into one transparent system.

"Our customers need seamless information," Carter says. Thus, FedEx is working on a project to offer customers online tracking data at Fedex.com, whether the shipment is an overnight letter to Chicago or an airplane full of car parts in Milan.

UPS, too, is upgrading its handhelds. The company is also focusing on automating processes at its sorting facilities in an effort to reduce training costs. And like its competitor, UPS is leveraging its IT expertise to become a logistics outsourcer.

With both FedEx and UPS consistently hailed as best-practice and innovation leaders, the evolution seems like a natural. ◗

Ulfelder is a freelance technology and business writer in Southboro, Mass. Contact him at sulfelder@yahoo.com.

DATELINE

1979: FedEx launches COSMOS, its centralized übermanagement software, which manages delivery vehicles, packages and drivers while tracking weather shifts and even traffic jams.

1980: FedEx introduces DADS, its wireless data network.

1984: FedEx rolls out PowerShip, the first PC-based automated shipping system.

1986: FedEx introduces SuperTrackers, the handhelds its drivers still use today.

1990: UPS rolls out its own handheld, DIAD.

1995: UPS opens its Atlanta data center, featuring the world's largest DB2 database, with more than 11TB of data.

DEC. 22, 1998: Daily online tracking requests at UPS.com top 1 million.

2002: UPS creates Supply Chain Solutions, a supply chain outsourcing division.

WIRELESS HUBS

Find out how FedEx and UPS are using wireless LANs in their hubs to increase the efficiency of internal workers:

QuickLink 32164
www.computerworld.com

1991: The National Science Foundation lifts restrictions on commercial use of the Internet.

APRIL 1992: Microsoft releases Windows 3.1.

1992: SAP AG releases SAP R/3.

MARCH 1993: After losing half its market value, IBM selects Nabisco's Louis V. Gerstner as its new CEO.

AUGUST 1993: Apple ships the Newton MessagePad, its first personal digital assistant. →

SEPTEMBER 1993: Peter de Jager publishes the first warning about Y2k in *Computerworld.*

MARCH 1994: Marc Andreessen and colleagues form Mosaic Communications Corp., which later becomes Netscape Communications Corp. ↓

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Banking On TECHNOLOGY

Banks and brokerages like **FIDELITY, SCHWAB, CITIBANK** and **WELLS FARGO** have used technology to better connect with consumers in an increasingly cutthroat marketplace.

By Mary Brandel

IT WAS 1970, and Steve Schutze was in charge of a project to install the first two automated teller machines at the National Bank of Detroit. This was pioneering stuff, even though these stand-alone cash dispensers of 30 years ago were nothing like the real-time, round-the-clock networked machines of today.

"One challenge was getting them to dispense currency correctly and not jam," says Schutze, now director of e-strategies at the American Bankers Association.

Today, of course, networked ATMs with full-graphics screens, multiple currency capabilities and account management features represent "the bank" for 70% of the U.S. population.

Rather than simply cutting costs, the ATM revolution — combined with other self-service channels in financial services such as interactive voice response systems in the 1980s and Internet trading and banking in the 1990s — gave consumers unforeseen flexibility. Other aggressive technology deployments — such as online transaction-processing systems in the mid-'80s on the banking side and multitasking Unix workstations and servers on the brokerage side — established the industry as an early leader in the use of IT for competitive advantage.

PIONEERING INDUSTRIES

The financial marketplace has grown only more cutthroat through the years. The intense competition has forced financial institutions to continue to invest heavily in IT as they seek to maintain an edge.

"In today's world, financial services and technology are inseparable," says Steve Elterich, CIO at Fidelity Investments in Boston.

According to a recent report by Forrester Research Inc. in Cambridge, Mass., the financial services industry spends more than 8% of its revenue on technology, among the highest of all industries.

In the early 1970s, banks made huge investments in back-office mainframes and check-processing machines to slash the costs of laborious banking processes. By the 1980s, 20- to 30-ft.-long machines were processing 1,000 checks per minute, driving costs for large banks down to 5 cents per check.

Bank tellers in the early '70s served customers using machines that were more like calculators than computers. But in the mid-'70s, banks such as Wells Fargo Bank began installing sophisticated teller terminal systems that sped up processes like checking account balances.

At the same time, banks were also quick to jump on the minicomputer bandwagon, using packaged applications to perform duties such as processing loans, deposits, customer data and financial information. "For the first time, small banks were able to buy turnkey systems and do their own processing, rather than relying on service bureaus," says Art Gillis, a Dallas-based consultant who has been working in the computer industry since 1958.

In the early '80s, banks networked ATMs to their central systems, making it possible to give customers real-time balance information and eventually creating a national network. In the mid-'80s, banking customers were introduced to the concept of phone systems that responded to voice and touch-tone prompts. Other industries looked on as banks (along with airlines) deployed online transaction processing systems that enabled fast transactions, split-second decision-making and optimal use of time.

Meanwhile, brokerages such as Fidelity and Charles Schwab & Co. were opening up sophisticated phone centers in the mid-'80s, providing customers with automated access to account balances, as well as touch-tone trading in the late '80s and voice recognition in the late '90s.

Investment firms such as Solomon Smith Barney will be remembered as the pioneers that brought Unix into commercial environments. Because of the multitasking capabilities of Unix workstations, as well as the power of relatively inexpensive large Unix servers, the investment industry flocked to Unix, effectively opening the rest of the world to its possibilities.

Banks were more open to PCs. "In the early '80s, IBM sent free PCs to all the CIOs at the major banks," says Schutze. "They all said, 'What would I use it for?' IBM forgot they didn't want PCs; they wanted something to do with those PCs."

Over time, PCs found their way into the branches. "A lot of banks were deploying PCs when they were

JULY 1994: Microsoft modifies its operating systems licensing terms to end a four-year antitrust investigation.

NOVEMBER 1994: A flaw is discovered in Intel's Pentium CPUs that can cause incorrect calculations.

1995: Amazon.com, founded by Jeff Bezos, launches an online store for books and music. ↖

AUGUST 1995: Midnight crowds line up at computer stores as Microsoft releases Windows 95.

JANUARY 1996: After seven months of brewing, Sun ships Java. →

JAVA™

1997: The widely used DES encryption algorithm is cracked.

1998: The U.S. Justice Department and 20 states sue Microsoft for violating antitrust laws.

280s running DOS for customer service processes, like filling out forms," Schutze says.

John Reed, onetime chairman and CEO of Citibank (now part of Citigroup Inc.), was converting his bank's entire culture into one that used technology to differentiate itself, eventually turning consumer banking into a profit center rather than "the back yard of banking," says Robert Landry, an analyst at TowerGroup in Needham, Mass. "To be successful at Citibank, even on the business side, you had to have an understanding of how technology would help the business."

THE INTERNET AGE

The early '90s were defined by massive bank mergers, as well as the convergence of the banking, investment and insurance worlds. Technology projects in some cases were waylaid as IT groups struggled to integrate multiple back-office systems.

Despite those challenges, however, in 1995 Wells Fargo emerged as a Web pioneer, offering Internet access to customers, enabling them to check account balances and transaction histories, and later to transfer funds, pay bills and apply for loans. Along with New York-based Citibank and other large banks, San Francisco-based Wells Fargo is still one to watch when it comes to Web innovations.

Also in 1995, Schwab launched its Web site, and a year later, it began offering Internet trading.

PENNEY WISE

Geoff Penney, CIO at Charles Schwab, talks about the early days of the Internet:

QuickLink 32264
computerworld.com

"At one point in 1999, firms were adding 3,000 to 4,000 accounts per month," says Dan Burke, an analyst at Gomez Inc., a consultancy in Waltham, Mass. "Suddenly, it wasn't only the veteran discount players but upstarts like ETrade and Ameritrade coming on with sound technology at an extreme cost reduction."

Mistakes were made, of course, mainly to the tune of how to integrate the Web with the business. Citibank, for example, learned through its launch of Citi f/i that customers didn't want a standalone online bank but one that was blended with the bank's other online and off-line services.

San Francisco-based Schwab had a similar experience. "To begin with, we treated [the Web] as something separate," says Geoff Penney, CIO at Schwab. "If customers used E-Schwab, they paid a lower commission but didn't get the same level of services. We went 18 months before we integrated it back into the firm."

LARRY GOODE

In today's uncertain economy, financial firms must continue to use technology to hone their competitive edge.

For brokerages, the challenge is to step into more of an advisory role. They will do this, Burke says, by refining their Web sites — increasing the sophistication of their financial planning tools, making Web research easier to use, simplifying alert setup and ensuring that investment selection tools get applicable results.

Brokerage systems and Web sites will also become more account- and portfolio-oriented, Burke says. For instance, an adviser might get an alert when a client's portfolio allocation differs from the model that's been set up.

Similarly, banks also need to get into "help" mode, Landry says. "The No. 1 capability of the Internet is distribution of information," he says. "Banks can use it to play a big role in educating consumers as to how securities, banking products and insurance will help meet their lifestyle objectives."

The Internet, in the form of Web services, will have an even more revolutionary impact as a platform for building systems within banks and between banks and their partners, Landry says. "If a bank needs, for instance, a bond calculation, it can use Web services to find a program that can do that, as opposed to a programmer buying a piece of software, integrating it and supporting it for a long period of time," he says.

Corporations such as Citigroup and Wells Fargo will likely continue to lead with innovative Web capabilities, such as account aggregation.

Many observers, particularly in the brokerage arena, see wireless finally becoming an important channel for accessing accounts and carrying out transactions. "We're convinced wireless will be important," Penney says. "Will it be in the next five years? Who knows? Our objective is to know what we can do most effectively through wireless by experiencing it, not reading about it."

"Wireless has fallen out of favor in terms of being a trend, but that's because the right combination of technologies has not come together yet to make it user-friendly enough," says Elterich.

As innovations such as these continue, it's difficult to conjure up the days when IT was behind the scenes doing batch-processing functions. "I'm not sure the financial services industry was always a pioneer in the true sense of using new technology," Schutze says. "What it did was take technologies and integrate and deploy them differently. And that's where banks have done a tremendous job." ◗

Brandel is a freelance writer in Newton, Mass. Contact her at brandels@attbi.com.

DATELINE

1969: Chemical Bank installs the first ATMs.

1973: A consortium of banks (later Visa) introduces the first global electronic card authorization system.

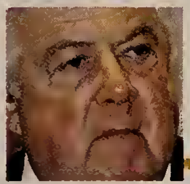
1984: Fidelity invests heavily in mainframes and phone centers. Charles Schwab launches a DOS-based application for PC-based trading.

1995: Wells Fargo becomes the first U.S. bank to offer Internet access to customers.

1998: Schwab claims 2.2 million online accounts. Fidelity introduces a speech-recognition capability over its automated phone service.

2000: Citibank account services allow consumers to consolidate their financial services in one interface.

FEBRUARY 1998: Compaq acquires Digital Equipment for $9.6 billion.



NOVEMBER 1999: U.S. Judge Thomas Penfield Jackson rules that Microsoft is a monopoly. ←

2001: HP announces a plan to buy Compaq for $25 billion. →

1999: The Y2k date rollover problem requires expensive code fixes and raises public alarm.

2000: Dot-com companies are decimated as venture capital dries up and stock prices collapse.

2002: WorldCom, which operates a major portion of the Internet's backbone, files for bankruptcy.

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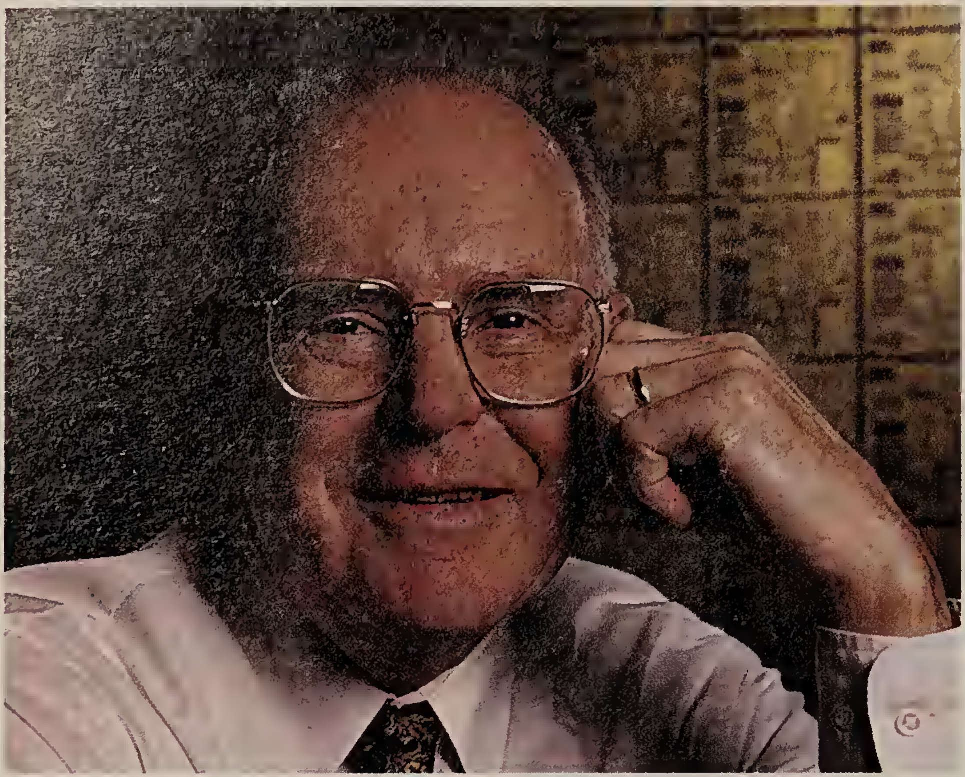

ANDY FREEBERG

Gordon Moore

AGE: 73

CLAIM TO FAME: Co-founded Intel Corp. Formulated Moore's Law, which, when posited in 1965, held that the complexity of an integrated circuit would double every year. In 1975, Moore amended the law to doubling every 18 months, and in 1995 to two years.

WHAT HE'S DOING NOW: Chairman emeritus at Intel. Co-founder and director of the Gordon and Betty Moore Foundation

What will be the most important advances in business technology in the next five to 10 years? I don't see anything on that time scale that's likely to change technology qualitatively. A lot more businesses are going to take real advantage of what's out there now. Looking probably further forward, when we truly get good speech recognition, I think that will be a dramatic change in the way things get used.

What do you see as the real promise of speech recognition? There's some simple things, like you talk to it in English and it'll spit it back out in French. I think the computer stops being a passive tool. If you had to interact with other people by poking buttons, if people just responded blindly to instructions you gave them, then it would certainly be a different world.

You have said you foresee amending Moore's Law to a four- to five-year cycle. Does that suggest an industry that's maturing? We're approaching atomic sizes where, as you shrink further, things don't behave properly. We've got a couple more generations, maybe more, before we enter some limits there. But the industry will still be moving at a phenomenal rate.

You've been skeptical about DNA chips and quantum computing. But they seem like natural extensions to Moore's Law. Quantum mechanics is so far from a practical device that I can't imagine it ever having a significant impact on what we consider the computing world today. For the DNA chip, again, it's hard for me to see how you can input data and get data out of something that's dependent on DNA for the execution. You can demonstrate these things in laboratories. But it's far from being, or even showing a pathway to, a practical solution.

Is there a time where technology development might be post-Mooreian, if you will? [Chuckles.] I'm writing a paper right now entitled "No Exponential Is Forever." Any physical thing that's been growing exponentially eventually comes to an end; it can't do it anymore.

— Michael Fitzgerald is a freelance writer in Oakland, Calif. Contact him at mikelark@juno.com.

PIONEERS & VISIONARIES

JIM GOODNIGHT

AGE: 59

CLAIM TO FAME: In 1976, he co-founded SAS Institute Inc. in Cary, N.C. At $1.1 billion, it is now the world's largest privately held software firm.

WHAT HE'S DOING NOW: SAS chairman, CEO and programmer

Could a couple of college professors today start a software company in a garage and see it grow to $1 billion? Of course that would be possible. This is America. The cost of entry into the software business is a lot lower today because you can buy a computer for $1,000 and off you go. But in my day, it cost that much for a keypunch machine, and then you had to rent time on a big mainframe.

What's the future of data mining and data analytics? We see data analytics as helping to close the intelligence gap that so many companies are struggling with right now. They have enormous amounts of data in their [enterprise resource planning] systems and all their other online systems. The ability to get that data warehouse where you can do data mining and predictive work with it, that's what we are going to see a lot more of over the next four to five years.

What benefits might companies get? Some large companies recognize the value of their data, the ability to predict which customers might be leaving, which are likely to buy additional products, which ones you might be able to up-sell and so on.

Will Microsoft take over everything? I guess they have the ability if they wanted to. In general, Microsoft will continue to dominate on the desktop. We are seeing a move from the desktop to more of a browser interface, and it's pretty obvious Microsoft will dominate in that area as well.

– Gary H. Anthes

PAUL DAGYS

GORDON BELL

AGE: 68

CLAIM TO FAME: Father of the minicomputer: designer of the PDP line and head of development of the VAX series of minicomputers at Digital Equipment Corp.

WHAT HE'S DOING NOW: Senior researcher at the Media Presence Research Group at Microsoft Corp.

What's been the biggest technology influence on your life? You mean besides Moore's Law? It accounts for everything from the first transistorized time-sharing systems and the minicomputers I helped pioneer through PCs and, since 1995, clusters of thousands of PCs. Almost 30 years ago, I invented a corollary to Moore's Law that says a new class of computer forms every decade. It's the law of computer class formation – from minis to PCs to PDAs.

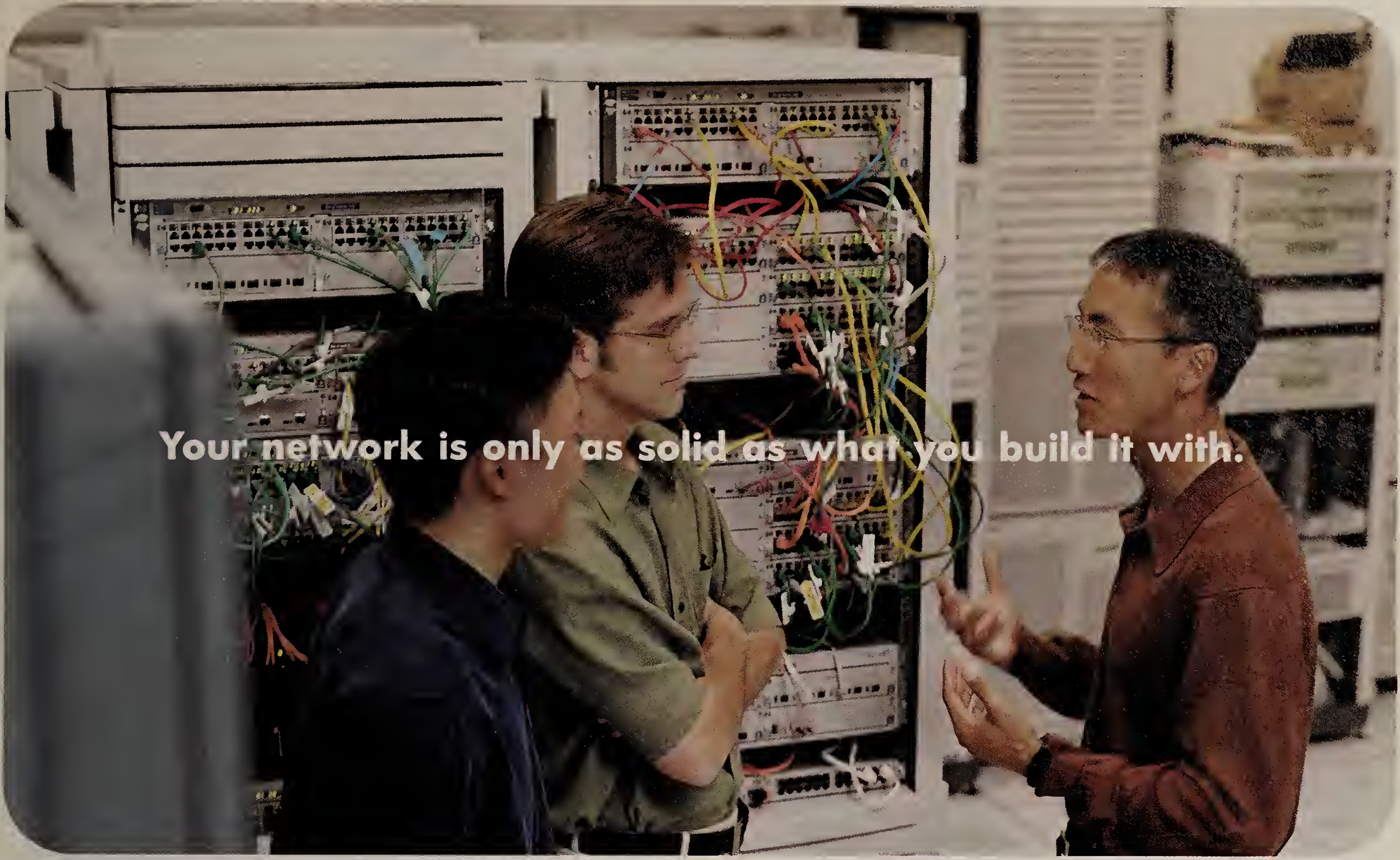
So what's next? A "put everything in a single chip" kind of computer, which will emerge at the several-hundred-dollar level. It will be a personal device that will remember everything in one's life – articles, books, correspondence including e-mail, music, video, voiced communication and on to Web pages. If you go out 10 years, you can basically carry your whole life with you. It will be the rebirth of the PC as a different tool.

What other technology changes will we see in our daily lives? Security is going to be the big deal. People will be authenticated any time they enter or use anything of value. This, together with [image recognition], permits complete person tracking.

Does anything worry you? What stands in the way of continued progress of Moore's Law? Lack of bandwidth may be my No. 1 concern, followed by a poor economy. The latter means fewer new systems and capital for new ventures. I'm in a very pessimistic mood about the economy.

– Gary H. Anthes

PROFILES CONTINUE ON PAGE 58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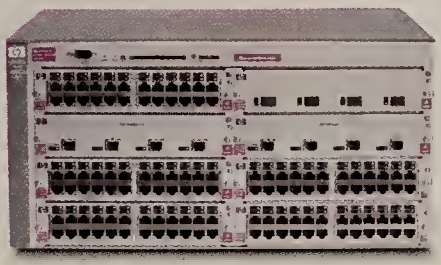

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Steve Ballmer

AGE: 46

CLAIM TO FAME: He joined Microsoft Corp. in 1980 as the first business manager hired by Bill Gates. In January 2000, he assumed full management responsibility.

WHAT HE'S DOING NOW: CEO of Microsoft

MILES ABOVE THE Pacific Ocean, a decade or so ago, Steve Ballmer had an epiphany of sorts. He was settling into a business-class seat on a U.S.-bound United Air Lines jet, returning home from a work trip to Australia and New Zealand. His laptop was powered on, and he had eight charged batteries at his side.

"I could carry my slides. I could carry my e-mail. I could carry anything I needed to read. I could carry my life with me. It was very powerful," Microsoft's CEO recalls, with characteristic enthusiasm. "I was thinking, 'Wow, isn't this cool? I can work all the way home.' "

Ballmer says he has no idea what type of breakthrough will inspire him to have a similar reaction during the next decade. But his basic premise is that, in a "quantum sense," systems will become "faster, easier to use, more flexible and more connected."

"If you say that to people, that doesn't sound that inspiring; that doesn't sound like such a breakthrough," he acknowledges. But even if it's just a computer with a spreadsheet, a word processor and a mail package, he foresees "such radical improvements on those fronts that it would look like a completely different experience."

PIONEERS & VISIONARIES

Ballmer speaks with passion about the Windows-powered Tablet PC, due this fall. He says he thinks some may be underestimating the excitement that will be generated by the lightweight, wirelessly connected PC, on which users will be able to tape and synchronize a presentation with their handwritten or typed notes, if desired.

And that only scratches the surface of technology voids that might be addressed. Ballmer notes that he doesn't have a watch with a computer built into it. If he did, he might wear one. He says he'd like to do a family slide show on his TV, with digitized pictures from his PC. "It's not an easy thing to do," he says.

Ballmer says most people still get only some of the information they need, and integrated views of data will become increasingly important, particularly in business.

Microsoft has been pushing XML to help pave the way. Ballmer says he expects XML's impact "to grow every day for the next five or six years," improving IT efficiency and productivity and systems management.

Another trend that Ballmer expects will escalate among IT organizations is the outsourcing of standard operations, freeing decision-makers to focus on the strategic aspects of their businesses.

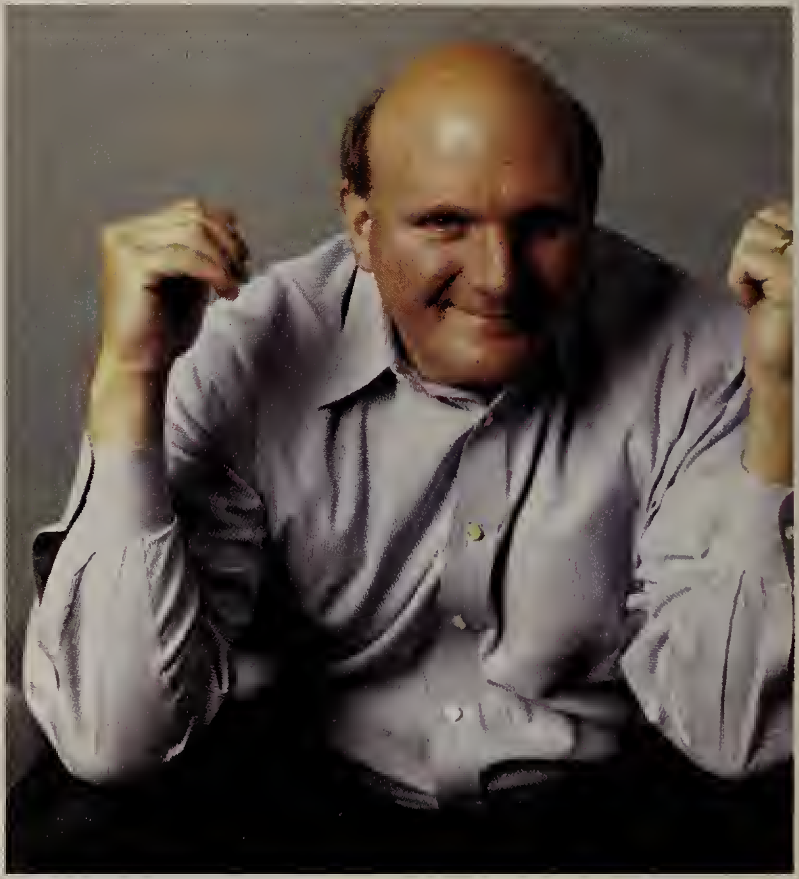
"If you go out 10 years in time, I'll bet you that most companies will not run their own knowledge worker infrastructure," Ballmer predicts. "You'll buy or subscribe to a service that gets the PCs, desktop productivity infrastructure and file sharing to e-mail and directory.

"You could think of it as software as a service, or you could think of it as outsourcing," he says. "It's kind of a mixture between the two."

In his own business, Ballmer says the vendors that will succeed during the next decade are those that have the "ability to add value through software" and "innovate but heed the customer."

"You can't just heed the customer. You can't just innovate. You have to do both," he says.

— Carol Sliwa



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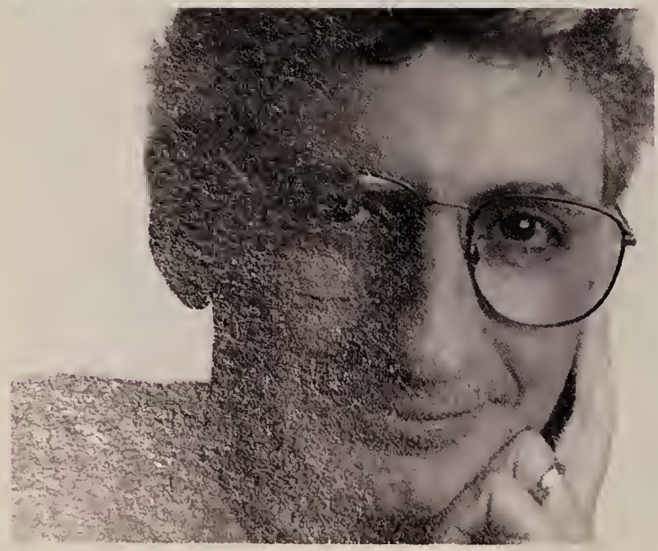


AGE: 57

CLAIM TO FAME: He began his career at IBM in 1970 at the Thomas J. Watson Research Center, where he started technology transfer programs aimed at moving research developments within IBM's labs into its product divisions.

WHAT HE'S DOING NOW: Responsible for IBM's next-generation Internet and grid computing strategies, IBM Server Group's advanced architectures and technologies, and the strategy and development of the company's Linux initiative.

IT MAY SOUND A BIT SELF-SERVING, given IBM's leadership role in utility-based computing, but Irving Wladawsky-Berger says he believes strongly that the hands-off model for allowing companies to pay third-party services firms to host and run high-capacity, ultrasophisticated business and research applications is the wave of the future.

Utility computing "makes available the promise of serious computing capacity and sophisticated computer applications on demand – just plug into it," says Wladawsky-Berger. The information utility approach "could give [businesses] access to information and applications that they have difficulty reaching today," such as making available to smaller engineering firms complex computer engineering analysis systems used by manufacturing giants such as General Motors Corp. and The Boeing Co., he adds.

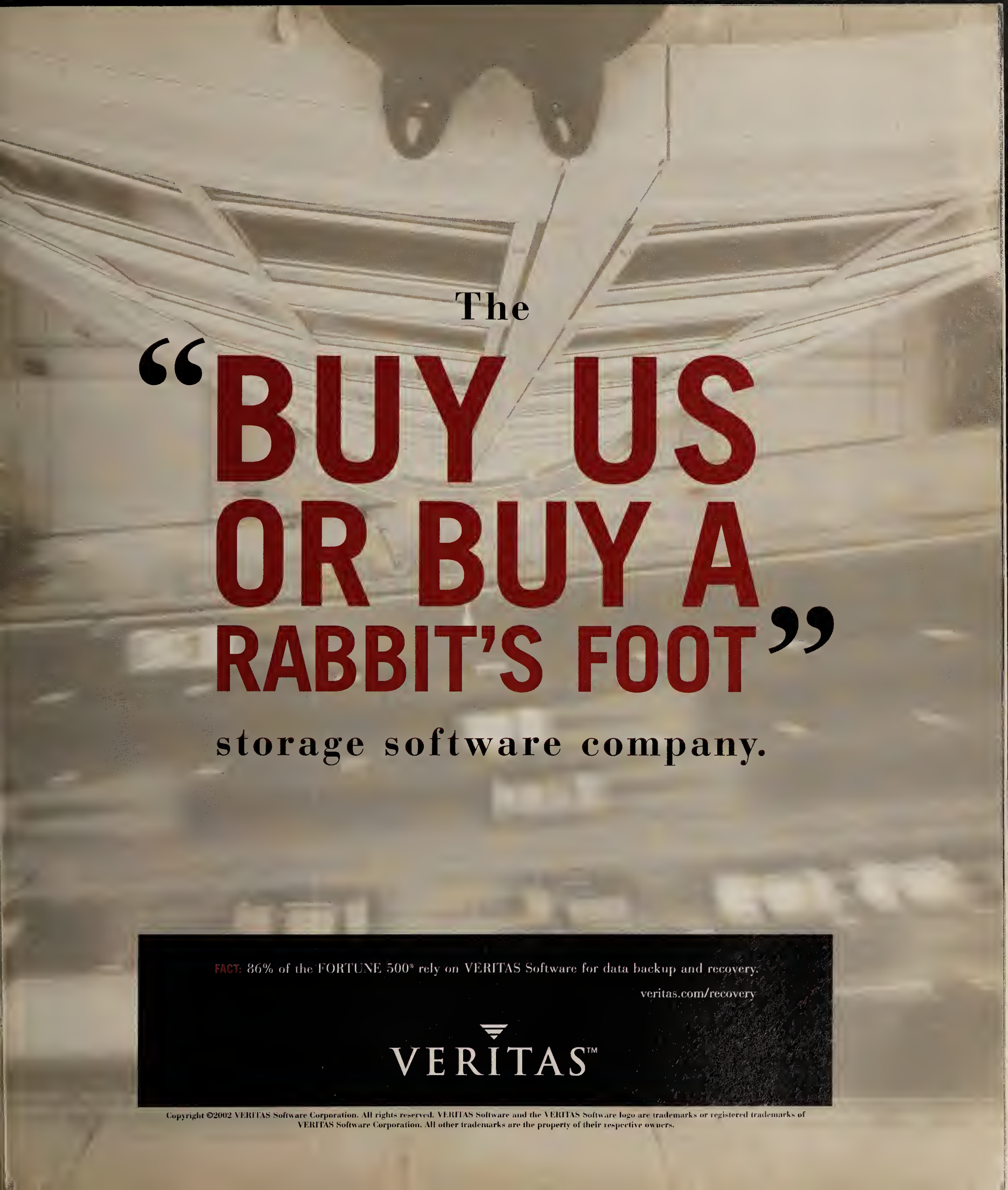
Still, Wladawsky-Berger acknowledges that there are several hurdles to overcome before utility-based computing becomes mainstream, including developing the needed infrastructure with "giant server farms" and more reliable bandwidth backbone. Not to mention the cultural changes needed for utility computing to succeed.

"For businesses to feel comfortable doing this, many of them will have to let go," he says. "If you hire a service, you can get access to a lot more skills than you can get yourself at a much lower cost."

Beyond utility computing, Wladawsky-Berger also expects that wireless technology will become more reliable, services will become more ubiquitous, and bandwidth capabilities will increase. These higher-bandwidth capabilities, such as Wi-Fi, will make it possible for companies to roll out new entertainment, educational and health care services to consumers – "health care that will be far more sophisticated than anything we can conceive of today," he says.

– Thomas Hoffman

PROFILES CONTINUE ON PAGE 60



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SANJAY KUMAR

AGE: 40

CLAIM TO FAME: Credited by customers with improving customer relationships and introducing more flexible software licensing policies in various leadership roles at Computer Associates International Inc.

WHAT HE'S DOING NOW: Named president and CEO of Islandia, N.Y.-based CA in August 2000

FOR A COMPANY THAT HAS GROWN primarily through acquisitions, one of Computer Associates' savviest plays was picking up Sanjay Kumar in 1987, then director of software development at UCCEL Corp.

Kumar's business acumen helped him quickly zoom through the ranks at CA to become the company's No. 2 executive in 1994, at the relatively tender age of 31. But it's Kumar's keen vision of how technological developments will affect businesses that has helped him steer the 26-year-old software giant beyond its traditional mainframe software roots and into global services and other high-growth areas.

Kumar predicts that wireless computing will be the next technological advance that alters the business landscape. "Many things that we've done [in computing], other than the cell phone, have been tethered," he says. Wireless standards such as 802.11b and Bluetooth "will untether the world" and allow businesses to send information instantaneously to customers, Kumar says.

He says he expects miniaturization to have the greatest effect on our day-to-day lives in the future.

"When the cell phone first came out, they were either installed in the car or came in this big camera bag," says Kumar. "Now we measure them in ounces." To that end, the proliferation of Pocket PCs and other small but increasingly powerful devices will make it easier for people to communicate and share information with one another, he adds.

Kumar predicts that within the next decade, most IT units will act as "specialty shops" that build applications unique to their businesses but will no longer develop software like human resource systems that can be bought from a third party. "Ten years from now, no one will have a homegrown manufacturing logistics or HR package" in place, he says.

Kumar also predicts that technology will help corporate employees become even more productive. "We're in a cycle where technology is helping people but creating a [productivity] wake," he says. "There'll be a big swing in the next five years to get that productivity to an all-time high."

– Thomas Hoffman

PIONEERS & VISIONARIES

Carly Fiorina

What drives the consolidation that the HP/Compaq merger exemplified, and how long will those drivers exist? Customers' absolute requirement for interoperability and for a more global-scale and solutions-based orientation. That's a trend that will continue into the foreseeable future. The software industry is going to consolidate; you'll see the services industry continue to consolidate. You will have players with scope and scale that win.

As a former telecommunications company executive, to what do you attribute the severe downturn in the telecom sector, and what will it take for it to recover? A false set of economics was created. You had a whole set of companies who were building capacity based upon economic models that were driven by regulation and legislation, not dollars and cents. Some degree of consolidation will have to be permitted. And we have to take another look at the regulation and the legislation that impinges on the telecom industry.

Where do you want HP to focus its research and development efforts in the future? Core technologies that we think have the opportunity to change the game, like nanotechnology, like atomic-resolution storage — really applying biology to the process of microprocessors and storage.

What technology advances will have the greatest impact on the way corporations conduct business? What it's all about now is connecting up what are today separate systems, connecting up what are today separate companies. That's going to drive a whole wave of changes in how companies do business and a whole wave of IT purchases over the next five to 10 years.

You've had a pretty monumental task in executing the merger. What has been the most difficult part so far, and what do you see as the most difficult issues ahead? The most important measure of our success and our progress is how customers see us doing. And I think most of our customers have been pleasantly surprised by how quickly we moved out of the gate and how focused we remain on their issues, which is what it's all about.

That's what I would say is the most important aspect of our integration — that is, to keep the customer and the marketplace in mind. It's really easy to get very internally focused. This is a big job, and if we don't maintain our external focus at all times by making our customers and what's happening in the market fundamentally our tiebreakers for how we proceed to integrate, then we're going to miss it. And I think we've done a good job of that so far. We've really driven our priorities for integration around our customers and around our markets, and we need to keep doing that.

What advice do you have for corporate IT executives involved in these huge sorts of mergers? The first thing I would say — and this, by the way, applies to any IT manager, not just someone who's involved in a big merger — IT managers need to be almost business managers first and IT managers second. I mean, it really is all about the application of technology to business problems and the understanding of how to connect up various processes inside a business and various processes between partners who do business together. So if an IT manager doesn't understand the business context, they can't be successful. And I think that's true whether they're involved in a big merger or not.

Secondly, I guess I would say, particularly when you're involved in a big merger, IT priorities need to be driven by business priorities. A very simple example of that in our own case is a decision we made early on. One of our No. 1 priorities was to get our Web sites integrated on Day 1 so customers knew how to do business with us.

— Don Tennant

AGE: 48

CLAIM TO FAME: Executed the largest merger of its kind in history with Hewlett-Packard Co.'s acquisition of Compaq Computer Corp. Prior to working at HP, as the first woman to be named a top executive at AT&T, Fiorina guided the spin-off and initial public offering of Lucent Technologies Inc.

WHAT SHE'S DOING NOW: HP chairman and CEO

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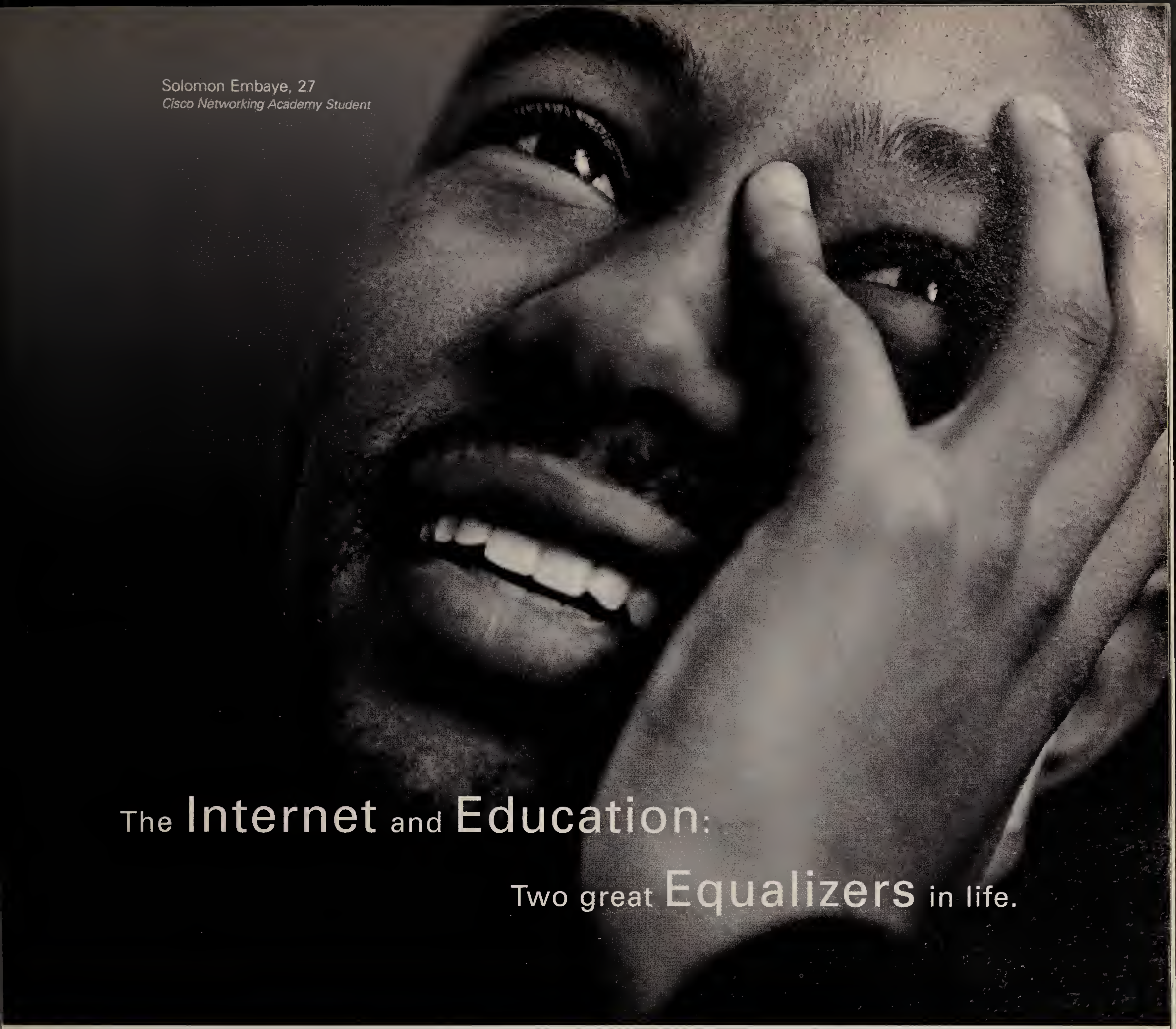
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JAMES MARTIN

AGE: 68

CLAIM TO FAME: A leading authority in computing, Martin is a Pulitzer Prize nominee, has written 101 textbooks and has honorary doctorates from schools on six continents.

WHAT HE'S DOING NOW: Founded Washington-based James Martin and Co., now called Headstrong Corp., which has a reputation for ultracomplex system development. Martin is chairman of WatchIT.com, an Internet-based education company that makes advanced-level and comprehensive IT education courses.

HAVING RESEARCHED AND WRITTEN more than 100 books on computing, James Martin has some clout in forecasting the next wave of technological advances.

The next big impact on business, Martin predicts, is real-time business-to-business systems.

That's because they offer many economic advantages. Early business-to-business systems saved a "considerable amount of money" for companies like General Motors Corp. and IBM, he says. But those were predominantly batch-oriented-type systems, whereas the next crop of business-to-business systems will be real-time networks, such as the ones that are driving just-in-time car production in Japan, says Martin.

In the automotive industry, for example, companies like Ford Motor Co. will increasingly rely on third-party manufacturers to build and ship them needed parts to build cars using real-time systems, says Martin.

For consumers, Martin says he expects to see "personal media machines" that people can use to program their TV and Internet viewing. He says these machines will be supported by the growth of the "wideband Internet," which will crest in the second half of this decade. For those reasons, the most successful technology companies will be those "that provide the most desirable applications for ultrahigh bandwidth networks," Martin adds.

IT leadership will look a lot different in 10 years, too, he says, as key technology decisions will be made by business executives, and almost all maintenance and development will be outsourced or sent offshore. Though Martin says IT will become highly integrated with the businesses it supports, "there'll be some things that senior management can't get, which I think is human nature."

– Thomas Hoffman

PIONEERS & VISIONARIES

Vinton G. Cerf

MARTIN SIMON

AGE: 59

CLAIM TO FAME: A "father of the Internet," he was a co-designer of TCP/IP.

WHAT HE'S DOING NOW: Senior vice president of architecture and technology at WorldCom Inc.; chairman of the Internet Corporation for Assigned Names and Numbers

What does the future hold for networking? Broader-band backbone networks will arrive out of optical switching, and wireless modes will become increasingly important. The Internet-enabling of mobile phones is an interesting development, and you can extrapolate that to include other capabilities, like PDAs being online. Looking much further out, maybe 10 years, there could very well be a significant impact in quantum communications. That could protect communications against intrusion, because intrusion is immediately detectable in quantum communications.

How about applications? There will be a very large number of devices on the Net — appliances, things you wear and carry around, things that are embedded in passive things like wine corks and your socks. But none of that will work very well if we can't secure things so people don't go around reprogramming all those devices and making life hell.

What else worries you about the Internet's future? I'm concerned about the economics of the Internet. As we see so many companies struggling to make their business models work, one has to ask, Do we understand the economics of the system? Do we understand what the pricing structures have to be in order to support an expanding Internet? We are seeing significant disruptive effects on the telecom industry as we move closer to flat-rate pricing.

How would you like the Internet to evolve? There's a question as to whether the Internet will create a homogenization of culture, but I continue to hope that it will be a tool for preserving a great deal of culture that would otherwise be lost.

The idea that we might ultimately have a great deal of our human history, as well as our current knowledge, online is very exciting to me. It really is an amazing prospect that most of what we know as a human race could be accessible to literally everyone.

— Gary H. Anthes

NICHOLAS M. DONOFRIO

AGE: 57

CLAIM TO FAME: As the top technologist at IBM and holder of seven patents, Donofrio oversees the development and commercialization of advanced technologies.

WHAT HE'S DOING NOW: IBM's senior vice president of technology and manufacturing

Where's the big opportunity for innovation? Big things will get bigger, small things will get smaller, things that are fast will get faster, and things that are dense will get denser. Technology moves so quickly that megabytes and nanoseconds will be passé in 10 years when memory capacity is measured in terms of yottabytes [a million-trillion megabytes of information] and processor clock speeds are gauged in terms of yoctoseconds [10 to the minus-24th power].

But how long can this pace of innovation continue before you start pushing the limits of physics? In all candor, there's little reason for worry for the next 10 to 15 years. We know these issues and are prepared for it. You might get worried about semiconductors, but there are self-assembling [carbon nanotube] structures that are being worked on. We have alternative storage devices and nonvolatile technologies. I have a lot of faith in semiconductors, parallelization and virtualization.

Why are you so excited about the confluence of IT and biology? We need a frame of reference to go forward in the IT industry. We are constantly looking for models. Biology and the human structure help give us those models, whether it is the Internet with its self-routing mechanisms or autonomic computing. How do we remember things? How do we store things? How do we build on the references we have on an instantaneous basis? There are a lot of lessons we can learn from ourselves.

– Jaikumar Vijayan

PROFILES CONTINUE ON PAGE 64

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Larry Ellison

AGE: 58

CLAIM TO FAME: Founded Oracle Corp., today the relational database market leader, in 1977.

WHAT HE'S DOING NOW: Has been running the company ever since as chairman and CEO

What do you think we'll be talking about five years from now in the IT business? I think we'll talk about a computer industry that's maturing. The whole Silicon Valley scene will be gone. It's been "winner take all" in mainframes, and "winner take all" in desktop computing, and I think you'll see a similar consolidation in whatever you want to call it — enterprise computing, infrastructure, data center computing. I think for enterprise computing [software], we're a survivor, SAP's a survivor, and IBM and Microsoft can be put in that realm to some degree. That's a pretty complete list.

Will that be a positive change for IT managers, or will it reduce their choices? It definitely will reduce their choices. But it's not clear that consolidation hasn't delivered better reliability and better economies.

What will IT departments have to do to prepare? They really should be information or knowledge organizations, not IT organizations. Understanding the details of technology is a silly thing for every company to have to be able to do well. I think you'll have a lot more outsourcing.

So, what will a typical IT department look like? There will be a lot of internal analysts, people who look at the information and try to understand it and figure out what kind of information you need and don't have. But a lot less hands-on people [writing software] in C.

Do you see any radical changes ahead for Oracle? No, not radical, other than surviving.

— Craig Stedman

MATTHEW SZULIK

AGE: 45

CLAIM TO FAME: He's a major and vocal booster of open-source software, advocating its use in environments ranging from corporations to schools. He's made a commitment to make open-source software available to U.S. schools free of charge to improve technology education in cash-strapped districts.

WHAT HE'S DOING NOW: CEO, president and chairman of Red Hat Inc., the leading Linux operating system vendor in the U.S. market, in Raleigh, N.C.

In a world of flashy space shuttles and supercomputers, the biggest technology influence on the life of Matthew Szulik has been the homely telephone.

"It gives you the ability to reach people instantaneously and make decisions rapidly, at a comparatively cheap price," he says. But as important as the phone has been, the future of technology innovation holds even more promise, says Szulik.

In particular, the continuing miniaturization of devices will have a growing impact on our lives, especially in the fields of health care and biotechnology, he says.

"This generation takes it incredibly for granted. If you've ever had a knee problem, what was once a year's rehab can now be 30 days," thanks to huge advancements in microsurgery made possible through technology, Szulik says. Also to come are advancements in disease discovery and treatment through greater use of case-study databases, he says.

In business IT, the changes will come in improved security and user recognition, as well as in new approaches to using computers, says Szulik. Accurate and faster ID authentication will allow people to use any computer anywhere and be secure, he says, while computers will eventually be so integrally built into our homes and businesses that accessing them will be as easy as plugging in a lamp.

"We'll be buying computer power the same way we buy electricity in 10 years," Szulik predicts.

- Todd R. Weiss

PIONEERS & VISIONARIES

TOM SIEBEL

AGE: 49

CLAIM TO FAME: In 1993, founded customer relationship management (CRM) software maker Siebel Systems Inc. in San Mateo, Calif., now recognized as the market leader. Prior to that, he was CEO of Gain Technology, a multimedia software firm. From 1984 to 1990, he was an executive at Oracle Corp.

WHAT HE'S DOING NOW: CEO of Siebel

What's been the biggest technology influence on your life? The relational database. I think the relational database was a very, very important development that dramatically affected the economics of computing. I think much of the work we do, the entire applications software industry, is built on the foundation of the relational database technology. The entire application software industry would be a fraction of what it is today without this fundamentally enabling technology.

What will be the next technology advance that will radically change the business landscape? The most important advance will be business process computing. . . . Today, the application software industry consists of a collection of screens and reports and associated business logic we customize or modify to meet the requirements of an industry or company, and we have various tools and languages we use to modify the data presentation workflow and underlying data structure. The next breakthrough will be when we begin to view an application not so much as software, but as collections of best practices.

What will the IT organization look like? The organization will look less like [a group of] programmers and configurers and installers of software, and more like [a group of] business experts who can describe and modify business processes.

What kind of role will computers play in business 10 years from now? I think the computer itself will become marginalized. I think it will be something of very little value 10 years from now that is ubiquitous and taken for granted and very low-priced. It will be like a paper clip in terms of form factor and cost, and at the same time have enormous utility.

- Marc L. Songini

PROFILES CONTINUE ON PAGE 66

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Michael Dell

What is the biggest thing happening in computing today? We're pretty excited with wireless. There's still a lot to happen in business and the home to help people be constantly connected. With wireless, you are able to be connected at high speed to data. And it's more-rich media, with sound, video and those kinds of things that drive massive amounts of storage. Computing devices go everywhere.

What advances will follow this trend? Nanotechnology and communications will be in everything. All kinds of other devices will attach and link together, centered, I think, with the PC. But if you think about the user today, you've got a lot of disconnected devices that don't talk to each other, and the user has to be the integrator. Some devices, like the PDA, connect to the PC, but the phone doesn't really connect. Integration is a key coming technology. Wireless connects them all together.

A whole lot has to be done in ease of use. Anyone can operate a TV, and while computers are more portable, they are still not simple enough for anyone to use. That's a barrier we all need to work together to improve.

How will we interact with computers in the future? We've come a long way. We used to have punch cards, then numbers, text, colors and windows. The next innovation is basically interacting as we do with each other. Speech and plain gestures and much more natural interfaces will make computers more accessible. Speech is getting better, but it has to be pretty good to take over from a keyboard. I know it's going to happen, but it's just a question of when.

AGE: 37

CLAIM TO FAME: In 1984, Dell founded Dell Computer Corp. In 1987, the company was the first to offer next-day direct computer sales.

WHAT HE'S DOING NOW: CEO of Dell Computer in Round Rock, Texas

What other trends in computing will matter years from now? As we all develop great technologies, an important thing is how do you make them affordable and reliable, and how do you get them to customers all over the world? One contribution Dell has made to this industry is we've dramatically reduced the cost of reliable computing, with a high level of service. That's caused others to have to react to that. Computers are more affordable than they ever were.

Contributions to the industry don't always come from the lab. Dell has 1,400 patents and 4,000 research scientists, which is important, but business models matter, too.

What you are seeing is failed business models now, with WorldCom and some others, due to bad leadership and bad boards of directors and more. That shows that it's just as important to have a good business model to sustain success.

—Matt Hamblen

PIONEERS & VISIONARIES

CRAIG BARRETT

AGE: 63

CLAIM TO FAME: Barrett was an associate professor of materials science and engineering at Stanford University when he joined Intel Corp. in 1974 as technology development manager. He rose through the ranks to head the world's biggest maker of microprocessors.

WHAT HE'S DOING NOW: CEO of Intel in Santa Clara, Calif.

What's been the biggest technology influence on your life? The biggest high-tech influence is probably the Internet as an information access device. I hardly use the telephone. I use e-mail compared to phone 99-to-1.

What advance will change our day-to-day lives? The next one is the elusive convergence of computing and communication and the whole wireless technology that's coming forth from 802.11 broadband and LAN wireless capability. We will have Wi-Fi hot spots becoming a network. We already have in some of our buildings 802.11 transmitters. If you ask anybody after having that technology for 30 seconds, it's pretty dramatic how much they want to keep it.

How will IT leadership change in the next 10 years? What will the IT organization look like? You are going to see a continuation of what's been happening, with IT going from a stovepipe organization to more of an interactive capability with business units. With the whole movement of e-business and e-commerce and the coordination of databases and the ability to access quality of data, those things require IT to be more of a partner. Our IT function is composed of two halves; one is e-business and the other a classic IT org, and they are already a combined backbone within the company.

Which companies will be the big winners in the next decade, and why? Certainly, I think e-business service-type organizations will continue to grow and prosper. The Accentures and those people who do consulting services will grow. I think others that prosper will make the transition from either a computing backbone or a communications backbone as those two technologies converge. . . . Companies with intrinsic capability in computing and communications will succeed. If you specialize in one, you'll suffer and find you have to be capable in both.

How much computing power will $100 buy in 10 years? If you assume Moore's Law for 10 years, you'll get at least 10 times the power, but the price points won't change. You'll just get 10 times [the] power for the same dollars.

– Matt Hamblen

ANNE WINBLAD

AGE: 51

CLAIM TO FAME: Winblad was one of the first female venture capitalists to launch her own firm and later specialize in software investments.

WHAT SHE'S DOING NOW: Since 1989, co-founding partner of San Francisco-based Hummer Winblad Venture Partners

What's been the biggest technology influence on your life? The advent of the microprocessor and the first affordable PCs allowed entrepreneurs such as me to build commercial code on low-cost machines. I was able to start a company with meager savings supplemented by borrowing only $500 from my brother. Moore's Law has had a dramatic impact on entrepreneurs: The microprocessor jump-started the software industry.

What will be the next technology advancement to radically change the business landscape? We're in the beginning of the move to shared system architectures. The rethinking of the application platform should permit more seamless external and internal applications, more autonomic computing environments, more personalization of user apps and the ability to deliver more useful information vs. just transaction- and workflow-oriented systems.

What will the IT organization look like? Rather than being composed of silos of expertise, we are beginning to see the convergence of database, storage and Web services. For IT, this may seem like a collision compared to integration, but it represents a move toward more programmable, manageable software, as opposed to a hardware environment, and will redefine the skill sets required of IT managers.

– Pimm Fox is a freelance writer in San Francisco. Contact him at pimmfox@pacbell.net.

WILLIAM MERCER MCLEOD

PROFILES CONTINUE ON PAGE 68

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35 YEARS OF IT LEADERSHIP

CAROL BARTZ

AGE: 54

CLAIM TO FAME: Bartz helped Autodesk Inc. turn AutoCAD, the company's flagship product, into the computer-aided design (CAD) application of choice for nearly 70% of the market. AutoCAD was one of the CAD systems used to design The Boeing Co.'s 777 airplane.

WHAT SHE'S DOING NOW: Chairman, president and CEO of San Rafael, Calif.-based Autodesk

What's been the biggest technology influence on your life? The invention of computer-aided design allowed engineers, designers and architects to create, revise, store and use digital design information. Today, CAD increases the value of information by keeping it in a digital format through its life cycle, which makes it easier to deliver when and where it's needed. This results in an unbroken continuum of digital design data stretching across the enterprise, supporting the delivery of live, easily accessible, interactive and intelligent information to any design data user, anyplace, anytime.

What will be the next big technology advance? Uniting the design power of the desktop with the reach of the Internet across a wide variety of markets will allow users to connect every step of the design process, from initial concepts and design through final build and sale.

How will IT leadership change in the next 10 years? Opportunities for women in IT management continue to be a problem for U.S. businesses. One of the solutions is to encourage more girls in secondary schools to pursue math and science. I really liked math and science in school, and if I hadn't gotten that background, I wouldn't be where I am today. [Girls today are] the "farm team" for tomorrow's cadre of women managers in IT.

Which companies will be the big winners in the next decade? Companies that strive to understand customers' needs. We listen to feedback and comments to ensure products we provide address specific markets. We believe strongly in educating the next generation of users and put emphasis on training and development for future designers and end users. Companies that have a broad customer base and a portfolio of industries can weather local downturns. We have reinvented ourselves from a one-product CAD company to a well-diversified business with many product families.

– Pimm Fox is a freelance writer in San Francisco.

Bob Metcalfe

YOU MIGHT BE SURPRISED to know that it's not networking but rather the Internet that has been the biggest technology influence on Ethernet inventor Bob Metcalfe's life, and it has been since 1969. "Google has changed my life," he says.

Metcalfe has had a long and storied career, studded with multiple awards and many prognostications. He divides his 35-year career into four parts. The first three are engineer/scientist, entrepreneur/executive and publisher/pundit/author. The fourth and most recent phase is venture capitalist, with forays into conference hosting and, as ever, speaking out on industry issues of concern to him. Not the least of these issues is what he sees as the soft-pedaling of the remedy phase of the Microsoft Corp. antitrust trial. "That's the only reason I can think of for electing more Democrats," he cracks, but then reconsiders. "It's not reason enough."

He says half-kiddingly that CIOs and their teams will vanish in the next 10 years because *everyone* will have to know how to apply information technology.

PIONEERS & VISIONARIES

"As information technology becomes more and more important and more prevalent, it will tend to blend into the woodwork," he predicts. A lot of what IT professionals do now is related to the fact that the technology today is "both wonderful and crap," Metcalfe says. Much of it rolled out the door prematurely. As technology quality improves, IT workers will be able to spend less time dealing with "incomprehensibility" and do more intellectually challenging things, predicts Metcalfe.

In the meantime, he can understand the hunker-down mode of many CIOs today. "It's not a bad thing, but while you are there, making better use of the investments already made, the company will start to outgrow what you've already built, and you have to be alert to signs of that," he says. Entirely new opportunities will be the lure to get IT out of this mode. "You'll see what you can't pass up," Metcalfe says.

That might include working with the next killer app — which is video Internet, according to Metcalfe. But be prepared to wait a while. He predicts that the technology will develop gradually over the next 10 years. That's because it will require massive re-engineering of the Internet — for example, a complete overhaul of TCP/IP and "all the Internet plumbing." Society will need to "broadband the planet," he adds, noting that people won't be viewing the "videonet" over a Digital Subscriber Line. "If it takes government intervention, then we are all doomed," he says.

Also coming are all forms of networked embedded computing. "There are 8 billion micros shipped every year, and only about 2% are personal and only about 2% are networked," Metcalfe says.

Among the advances he sees changing our lives are "major substitutions of communication for transportation," one example being the video Internet. The net result will be "a serious drop in commuting and business-related travel, less shopping in person, less investment in transportation infrastructures, less pollution and less money spent on wasting time and energy moving atoms around."

Looking ahead, if Metcalfe were forced to choose one technology to get involved in, it would be nanotechnology. "Wires, dots, wires. What the hell are they good for? We don't really know," he says.

In the shorter term, concepts like Tim Berners-Lee's semantic web — not people-to-people using HTML, but software-to-software using XML — will change the way business is done. "We'll be able to encode the information we put out in such a way that software agents related to business can be transacting, searching and interacting on our behalf continuously," he says.

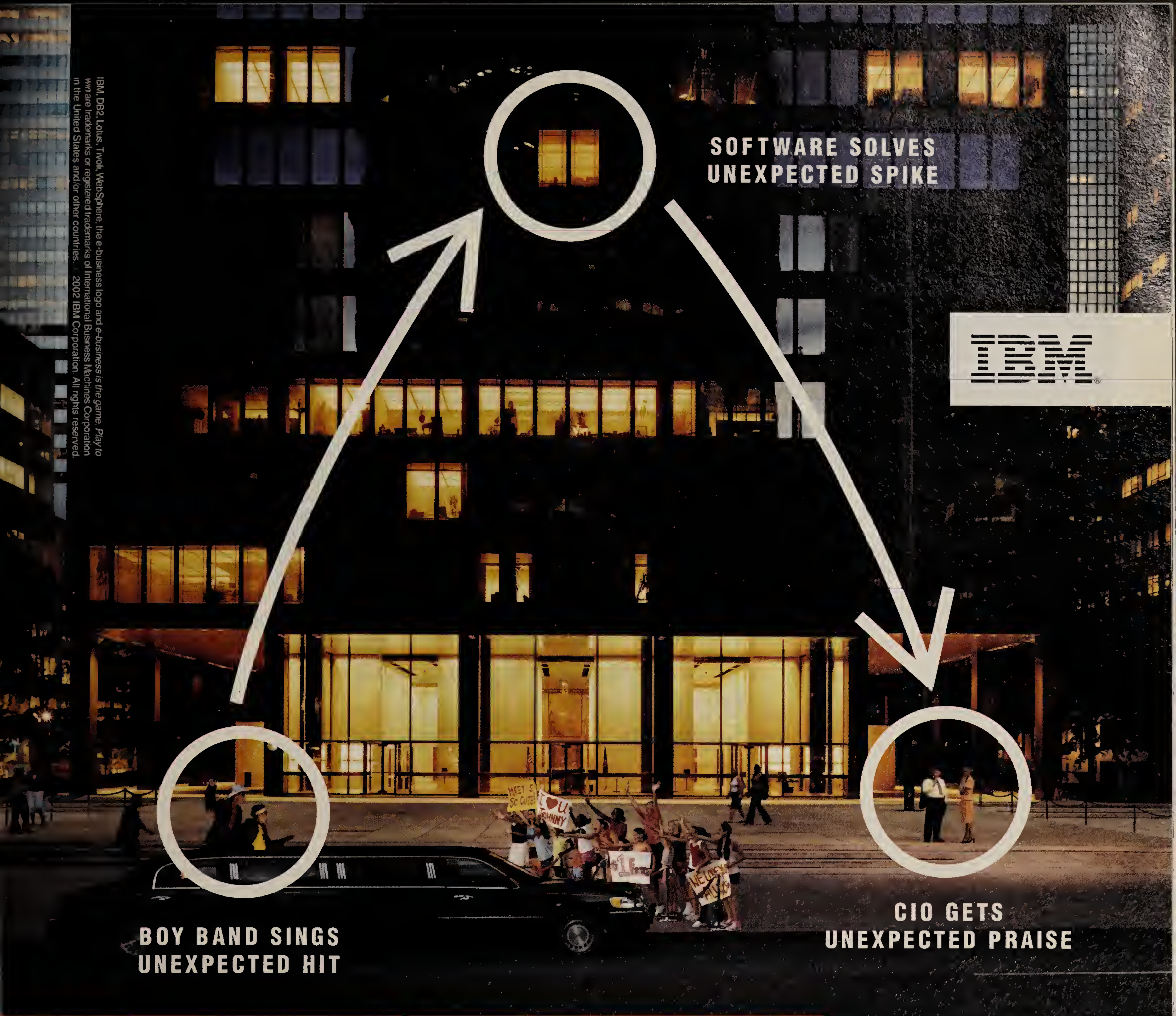
— Patricia Keefe

AGE: 56

CLAIM TO FAME: Inventor of Ethernet in 1973, a consulting associate professor at Stanford University, founder of 3Com Computer Corp. in 1979, creator of Metcalfe's Law, CEO of IDG's InfoWorld Publishing Co. (a sister company to *Computerworld*) from 1992 to 1995, and an *InfoWorld* columnist and industry pundit. Metcalfe is also the author of three books and the winner of numerous awards, among them the Grace Murray Hopper Award and the IEEE's Alexander Graham Bell Medal.

WHAT HE'S DOING NOW: Since January 2001, has been a venture capitalist focusing on Boston-area IT start-ups as a general partner at Polaris Venture Partners. He maintains various directorships and helps to run the Camden Technology Conference.

PROFILES CONTINUE ON PAGE 70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Scott McNealy

AGE: 47

CLAIM TO FAME: Co-founded Sun Microsystems Inc. in 1982, taking the CEO reins of the eventual global Unix powerhouse two years later. Dubbed "one of the most influential businessmen in America" by TV news magazine *60 Minutes.* For more than a decade, has trumpeted Sun's slogan, "The network is the computer."

WHAT HE'S DOING NOW: Chairman and CEO of Sun

What's been the biggest technology influence on your life? Professionally, that has to be the Internet Protocol, which is the ultimate Web service. Without IP, and the work [Sun co-founder Bill] Joy did in bringing IP to the [Digital] VAX and then to Sun OS in the old days, the whole Web thing wouldn't have happened.

A lot of the Netscape stuff was originally developed at the University of Illinois on Sun machines. Most of the Web development and important Web services have been developed, in large part, based on IP on Sun — XML and Java and NFS.

How about personally? It's a tossup right now between the cell phone, the answering machine and e-mail at home.

What will be the next technology advance that radically changes the business landscape? Wireless is the next big thing. There's just no question about that. The problem with IP historically is that requirement to be tethered to a machine on the network. Wireless IP will be the huge breakthrough.

What technology advance will change our day-to-day lives? Availability. The big, freaking Web-tone switch has not been very reliable in the past 20 years, but as it gets more reliable, we'll lean on it the way we do the phone today. Of course you have to put in there all the security features, the privacy protections, the conditional access, the authentication. We'll have multifactor authentication, and connection to the network will always be there — assured, private, reliable. Then you can start doing a lot more things very comfortably.

PIONEERS & VISIONARIES

I don't understand why I can't go to any hotel today, turn on Channel 50 or whatever on any TV, and with a wireless keyboard and fully functional Java browser have access to a high-speed network. Why can't every cable company and hotel hook me up, so I won't have to carry a PC around? I could be 100% productive from a hotel room without anything but an authentication card.

How will IT leadership change in the next 10 years? I see a lot more focus and a lot less vertical integration. More hosting of IT functions outside the organization and more focus on the information, on the customer registry. A lot less focus on running networks and data centers, or having to do all the integration work to assemble a big Web-tone switch. IT will get more critically focused on what's important and less focused on infrastructure and head count in the corporation. Providing services to your company's constituents — that's what will be important. IT should truly become the *information* managers, not the *infrastructure* managers.

What kind of role will computers play in business 10 years from now? Ubiquitous and invisible. Every product you use will be a computer. Already, your alarm clock is one. Your car is full of them. You'll be spending less and less time with computers you work on and more time with invisible ones. Software will be metal-wrapped (as in your car), not shrink-wrapped. When was the last time you upgraded the OS on your carburetor? These things just come as systems you use.

How will we interact with our computers in the future? I want my stuff to communicate to the network for me. I want my smart card to go out there and know I'm going to run out of gas in 50 miles and put it out for bid for the cheapest fuel. Then my car says, "Hey, here are your three options for gas: the closest, the fastest, the cheapest." That, to me, is how the Net should work. I want my house to delay running the dishwasher until a time of day when energy is cheaper, unless I override it.

I don't want to be on the Internet. I want to be golfing and playing with my boys.

— *Maryfran Johnson*

JAMES GOSLING

AGE: 47

CLAIM TO FAME: Created the Java programming language.

WHAT HE'S DOING NOW: Fellow at Sun Microsystems Inc.

What's been the biggest technology influence on your life? I'd have to give you an odd answer, which is drugs. If it wasn't for advances in modern medicine, I would not be alive today. In my particular case, about 20 odd years ago, I had a really bad case of amebic dysentery, and if it hadn't been for a mega-antibiotic, I would be dead.

What will be the next big technology advance? The area of the most profound impact over the next three years, in some senses, is an obvious extension of what's going on today, namely the sort of deeper and more pervasive penetration of the network. We've only begun to see what can be done with the network, and in particular, the interesting ones are going to be the intersection of embedded processing in intelligent devices and wireless.

What technology advance will most change our day-to-day lives in the next decade? One of the advances that could have a really important impact would be solving the last-mile problem. . . . The closest thing to a solution to the last-mile problem has been DSL and cable modems, both of which feel to me like a Rube Goldberg solution. You're hijacking one medium to do another thing, where the original medium wasn't really intended for that.

How will IT organizations change in the next 10 years? I would bet that in any fundamental sense, they're exactly the same as they have been for the last 10,000 years – big, bureaucratic messes of people. I mean, the Egyptians had IT organizations. They just didn't have the information technology, like paper.

But that said, there are technology trends that are clearly pushing these org structures in different ways. Networks are a big piece of it – the fact that everybody is able to talk to everybody else, that the various infrastructure systems that everybody's building are much less isolated than they were. The presence of a network port is assumed on every box.

What kind of role will computers play in business 10 years from now? It's pretty clear that in some sense, the track we're on is the obvious one: more communications, more computers, people using it to grease the skids between things. A lot of the pressure in the IT industry has been around getting information delivered to the right people at the right time.

- Carol Sliwa

PROFILES CONTINUE ON PAGE 73

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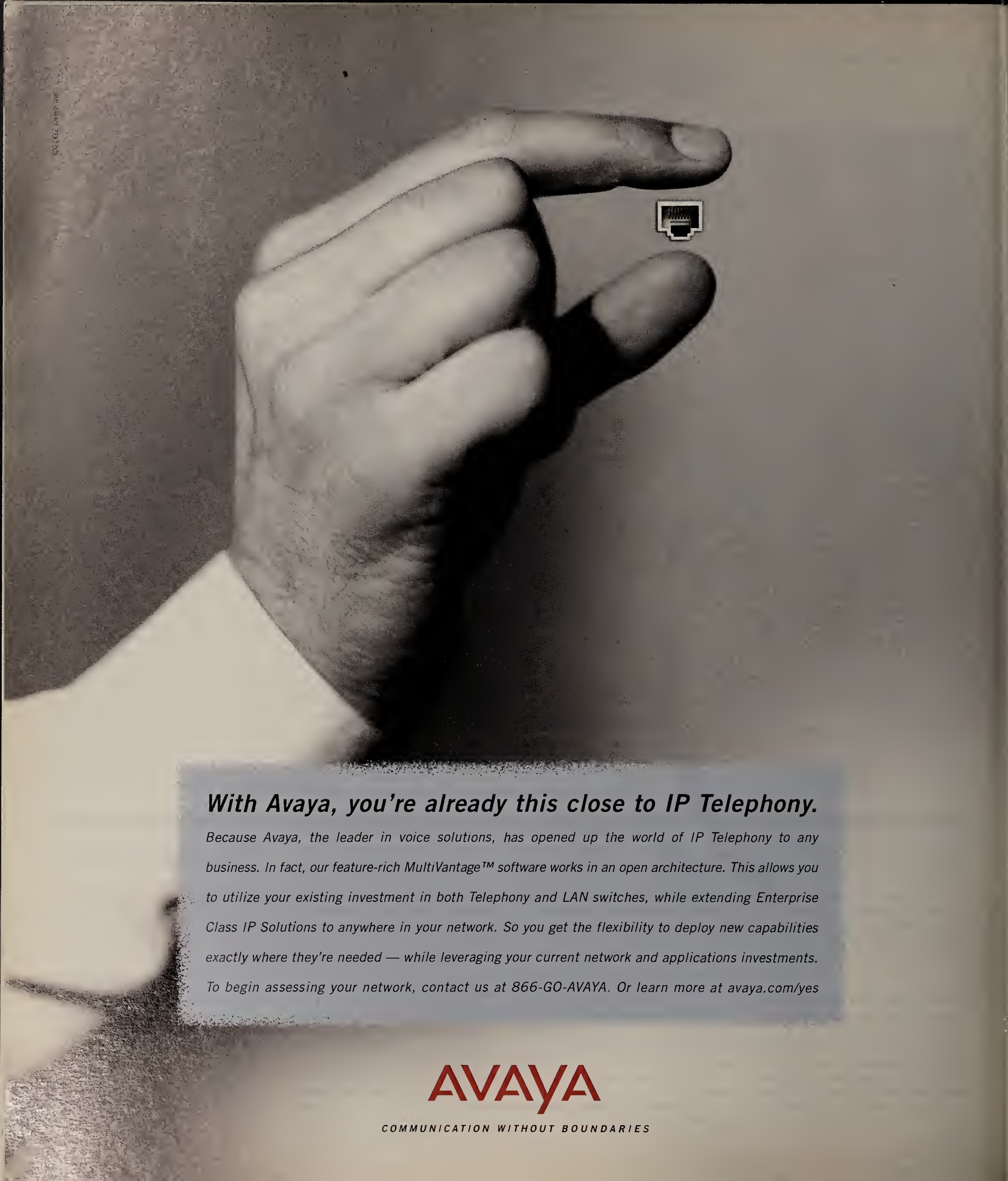

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COMMUNICATION WITHOUT BOUNDARIES

Esther Dyson

AGE: 51

CLAIM TO FAME: Her newsletter, "Release 1.0," which she took over in 1983, was a make-or-break for companies in the early days of the PC business. In her book *Release 2.0: A Design for Living in the Digital Age* (1997, hardcover, out of print); and its revision, *Release 2.1: A Design for Living in the Digital Age* (1998, paperback, available), Dyson explains how technology affects society, now and in the future.

WHAT SHE'S DOING NOW: Chairman of EDventure Holdings Inc. in New York

RAFAEL FUCHS

There are times when you've seemed bored with IT. Are you bored now? No, now I'm excited again. We're getting to a really interesting point with digital identity. The reason I went to Russia in 1989 is because IT was getting boring. Software was turning into a distribution business; groupware I'd written about. Now we've created this big virtual world full of data, but it's not terribly connected to the real world, and we're trying to actually integrate the two.

Is there technology coming that will change business the way the PC or groupware did? They're all extensions of each other. I mean, let's make groupware more usable, etc. In terms of really big things, it's going to be biotech, nothing to do with computers. And I think we all know that. But I'm not giving up on IT.

So, what are the big advances in IT in the next five to 10 years? In general terms, ubiquity. Wherever you go, you'll be online. It'll be a thing we just take for granted. All this knowledge management stuff will be much more effective. We'll be more effective in communications. We'll have much better tools for keeping track of what you're doing. All these things will have collaboration tools. We'll still have monitors, because they're nice to look at. But we'll also have monitors that are like roll-up sheets. I saw a keyboard like that recently, that we put on a bar in London. It shines the image of a keyboard onto a flat surface and has a little camera that picks up where you type.

Has the IT business crested? No. If you've dealt with an airline or a bank, you know they haven't finished building better systems. There's all the knowledge management stuff — so much to know and keep track of. It's painful to sit and put records into a database, so more and more of that will be automatically selected from e-mail. In good companies, your privacy will be protected.

But also, there are incredibly stupid design errors with technology. Companies can be so unintelligent, and unfortunately, it's not necessarily a question of better technology; it's a question of better designers using the tools that are there. I do think we'll make some progress, but I don't think everyone will be a great designer.

So there's a long, long way to go, even in the U.S. And in the rest of the world, the opportunities are huge.

— Michael Fitzgerald is a freelance writer in Oakland, Calif. Contact him at mikelark@juno.com.

JOHN GANTZ

AGE: 57

CLAIM TO FAME: Computing analyst since 1974 at IDC, Dataquest and his own firm, TFS Inc. Among his better-known predictions: said there would be no major dislocations from Y2k; debunked the 1980s hype around artificial intelligence, saying the business would go nowhere; and in the 1970s, predicted that the satellite business wouldn't have transponder shortages.

WHAT HE'S DOING NOW: Chief research officer and senior vice president at IDC

What's the next technology advance that will radically change the business landscape? There's something in these microelectronic machines, where you send these machines into your bloodstream to deliver drugs a lot better. They're using semiconductor techniques to create these little machines. They'll change the landscape in pharmaceuticals and medicine.

Do you think we'll be interacting with our computers differently in the future? I don't believe voice interaction is going to happen, other than maybe an occasional simple command for hands-free use. We'll pretty much be point-and-click.

Sounds like voice isn't going to be one of your choices for new applications. What will we see? Sharing pictures has become one of the primary reasons people communicate [online]. The software to search, to navigate, to classify and reclassify just isn't there for images. We're just at the beginning of figuring out how to deal with this new kind of data stream. I also don't think we understand what would happen if bandwidth were really plentiful and really free or close to free.

Information technology's been critical in terms of breaking geographic boundaries. You have these multinational corporations that run themselves pretty much like a single organism. Smaller and smaller companies will be doing business outside of their home countries.

The application we won't have is a fully integrated company with ERP, CRM and supply chain automation all talking together, the CEO sitting at some kind of war room console driving the business from this integrated piece of software. It's never going to work.

– Michael Fitzgerald

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THE BEST AND THE WORST

A look at the projects that bombed, the viruses that bugged us and other facts from the world of IT.

TOP 10 CORPORATE IT FAILURES IN THE 1990s

1. PROJECT: The "Confirm" reservation system for hotel and rental car bookings
COMPANIES: AMR Corp., Budget Rent A Car Corp., Hilton Hotels Corp., Marriott International Inc.
WHAT HAPPENED? After four years and $125 million spent on development, the project crumbled in 1992 when it became clear that Confirm would miss its deadline by as much as two years.

2. PROJECT: Conversion to a new order entry system from The Baan Co.
COMPANY: Snap-on Inc.
WHAT HAPPENED? Despite three years of design and implementation, a new order entry system installed in December 1997 cost the tools company $50 million in lost sales for the first half of 1998.

3. PROJECT: SAP ERP system
COMPANY: FoxMeyer Corp.
WHAT HAPPENED? Drug distributor FoxMeyer has claimed that a bungled enterprise resource planning (ERP) installation in 1996 helped drive it into bankruptcy. The case is still unresolved.

4. PROJECT: SAP ERP system
COMPANY: W.W. Grainger Inc.
WHAT HAPPENED? Grainger spent at least $9 million on SAP software and services in 1998 and 1999. During the worst six months, Grainger lost $19 million in sales and $23 million in profits.

5. PROJECT: Trips, a reservation and bus-dispatch system
COMPANY: Greyhound Lines Inc.
WHAT HAPPENED? Greyhound spent at least $6 million in the early 1990s building Trips. The debacle spurred a $61.4 million loss for the first half of 1994.

6. PROJECT: IBM-led installation and integration of SAP, Manugistics Group Inc. and Siebel Systems Inc. software
COMPANY: Hershey Foods Corp.
WHAT HAPPENED? To meet 1999's Halloween and Christmas candy rush, Hershey compressed the rollout of a new $112 million ERP system by several months. Sales fell 12% in the quarter after the system went live.

7. PROJECT: Systems integration with merger target Consolidated Rail Corp.
COMPANY: Norfolk Southern Corp.
WHAT HAPPENED? Norfolk Southern lost more than $113 million in business during its 1998-1999 railroad merger with Conrail.

8. PROJECT: New billing and claims processing system based on Unix International and Oracle Corp. databases
COMPANY: Oxford Health Plans Inc.
WHAT HAPPENED? A 1996 migration to a new set of applications for health maintenance organization operations resulted in hordes of doctors and patients who were angry about payment delays. All told, Oxford overestimated revenue by $173.5 million in 1997 and $218.2 million in 1998.

9. PROJECT: Oracle ERP and application integration
COMPANY: Tri Valley Growers
WHAT HAPPENED? A giant agricultural co-operative, Tri Valley bought at least $6 million worth of ERP software and services from Oracle in 1996. Tri Valley eventually stopped using the Oracle software and stopped paying the vendor. Oracle denied all claims. The case was settled in January 2002.

10. PROJECT: Software for estimating project costs and figuring engineering specifications, to be built and installed by Andersen Consulting
COMPANY: Universal Oil Products LLC
WHAT HAPPENED? After a 1991 ERP deal with Andersen resulted in unusable systems for Universal Oil, the industrial engineering firm cried fraud, negligence and neglect in a $100 million lawsuit in 1995.

SOURCE: *COMPUTERWORLD*, NOVEMBER 2000

MOST COSTLY COMPUTER VIRUSES

Based on worldwide economic impact:

1. Love Bug (2000)	$8.75B
2. Code Red (2001)	$2.62B
3. SirCam (2001)	$1.15B
4. Melissa (1999)	$1.1B
5. Explorer (1999)	$1.02B
6. Nimda (2001)	$635M

SOURCE: COMPUTER ECONOMICS, CARLSBAD, CALIF., 2002

U.S. COMPANIES WITH MOST U.S. PATENTS IN 2001

1. IBM	3,453
2. Micron Technology Inc.	1,643
3. Lucent Technologies Inc.	1,119
4. General Electric Co.	1,112
5. Advanced Micro Devices Inc.	1,090
6. Hewlett-Packard Co.	982
7. Philips Electronics North America Corp.	882
8. Intel Corp.	811
9. Texas Instruments Inc.	806
10. Motorola Inc.	785

SOURCE: IFI CLAIMS PATENT SERVICES, WILMINGTON, DEL., JANUARY 2002

TOP 10 BEST PLACES TO WORK IN IT

1. The Home Depot Inc.
2. PricewaterhouseCoopers
3. Wal-Mart Stores Inc.
4. Sears, Roebuck and Co.
5. UnitedHealth Group Inc.
6. Comerica Inc.
7. FedEx Services
8. J.B. Hunt Transport Services Inc.
9. Minnesota Life Insurance Co.
10. FleetBoston Financial Corp.

SOURCE: *COMPUTERWORLD*'S ANNUAL BEST PLACES TO WORK IN IT SURVEY, 1994-2002

This Date in History: SEPTEMBER 30

On this day in 1980, Xerox, working with Intel and Digital Equipment, published the specifications for Ethernet. Using Ethernet, the time to send a page from computer to printer could be reduced from 15 minutes to 12 seconds.

On this day in 1985, Microsoft released Excel, which it claimed was the fastest spreadsheet available for the IBM PC. Microsoft had announced the product in May and said it would be delivered in September. With the software's Sept. 30 arrival, the company kept its promise.

On this day in 1996, AOL sponsored the Monday Night Football game in Philadelphia to announce the latest version of its online service. The company invited analysts and reporters to the event and handed out free software in the parking lot.

SOURCE: HISTORYCHANNEL.COM, 2002

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If organizations want to flourish in the global economy, leaders need to nourish their employees. Our Women in Technology International (WITI) FastTrack coverage will cover the trends and techniques of leading companies around the United States. If you're interested in a top IT environment offering first-class treatment, check out WITI FastTrack. The list below offers just a sample of the exceptional employers featured in this supplement.

- *AOL Time Warner*
- *Capital One*
- *Mercury Computer Systems, Inc.*
- *Raytheon*

For more information on WITI FastTrack, please call Janis Crowley at 1-800-762-2977 ext. 7607, or email at janis_crowley@itcareers.net.

Web Programmer. Within Technology Department, Internet Development group is responsible for development of both JNL Internet and Intranet sites, and associated application development. Web Programmer functions as a mid-level technician working on moderate to complex work requests.

As a member of project team, responsible for application design/analysis; developing project plans; coding, testing, documenting all code; and maintaining and upgrading existing applications. May interface with customers to assist in the implementation and solution design of work requests. Must code, debug and test application programs utilizing JAVA and web-based programming tools. From a set of written specifications under general guidance of Project Manager or Senior Team Member, must be adaptive to the use of new software aids and programming techniques as acquired and adopted within IT in order to achieve the goal of providing world-class corporate web site. Minimum requirements include Bachelor's degree or equivalent in education and/or experience plus 2 years experience in job offered or related occupation of Programmer, Systems Analyst, Application Developer, Software Engineer, Network Administrator or combination of above. Experience must include at least two years experience in relational databases, one year experience in application development utilizing JAVA and one year of experience in at least 3 of the following web programming tools: Rational Rose, JAVA Servlets, JSP, XML, UML, WebSphere, EJB, and JAVA Beans. Must pass CPAB (Computer Programming Aptitude Battery) exam, required by employer of all applicants. Please mail resumes to Jackson National Life Insurance Company, attn Destiny Southwell, One Corporate Way, Lansing, Michigan 48951

Infinite Computing Systems a Cedar Rapids, IA company is seeking qualified computer professionals for our growing team. Current available positions must meet the following minimum requirements. All positions require at least a Bachelors degree (foreign Bachelor degrees are acceptable):

- At least 1 yr exp as a computer professional, including at least 1 yr exp in Harris transformer, Expeditor, IDMS, DB2, UNIX, Fortran, C++, File Aid, and IMS DB/DC.
- At least 5 yrs exp as a computer professional, including not less than 1 yrs exp. in EasyTreive, OMF, MF-CICS, MF-COBOL.
- At least 5 yrs exp as a computer professional, including 5 yrs exp. in C, C++, VC++, Oracle, GUI, SOL Server and at least 2 yrs exp leading and managing professionals in developing, installing, and maintaining computer applications and systems.
- At least 5 yrs exp as a computer professional, including not less than 2 yrs exp in Rational Rose, DB2, EJB, Java, Websphere, Visual Age.
- At least 2 yrs exp as a computer professional, including 2 yrs exp in MS-Translation Server, Visual basic, Developer2000, MAGIC, Oracle, and SOL Server and at least 6 mos. experience in Dream Weaver, PowerBuilder and Sybase.
- At least 3 yrs exp as a computer professional, including 2 yrs exp in SAP, Java, HTML, ABAP, BEA Weblogic, and 1 yr exp in Webmethods B2B Server and Enterprise Server, EDI, and Cognos Power Play.
- At least 2 yrs exp as a computer professional, including 2 yrs exp in Formware, ICR/OR recognition technology, Imaging, Document management, File Net, PC-Docs, Visual Basic, Java, and SOL Server.

Systems Analysts responsible for design and development of software applications for the company and its clients. Help clients in state-of-art internet and client server technologies under Windows NT using VB Script, COM, ActiveX and JavaScript. Responsible for writing code in Visual Basic and Java using Object Oriented Programming Techniques. Use Object linking and embedding technologies and ActiveX to make the applications reusable. Must have a Bachelor's degree in CS or foreign degree equivalent. Must have 2 yrs of exp, in the job offered. Salary: Competitive. Send resume to: Raj Shekaran Software Research Assoc 70 Mansell Ct. Ste. 100, Roswell, GA 30076.

Software Engineers (St. Louis, MO): Under close supervision of project manager, will develop large-scale web-based management information system applying object-oriented programming technology using C/C++, Java, JSP and EJB in a three-tier client/server environment on Window/Unix platforms; develop detailed technical design specification according to Rational Unified Process (RUP) for further developing applications in Weblogic Server using XML, RMI, SOL and Oracle; interface Oracle to Java applications through JDBC and Swing; evaluate interface between software applications and operational /performance requirements of overall system; develop client side GUI screen using Jbuilder, JavaBeans and JavaScript; and perform troubleshooting and system tuning using system traces and debugging tools. Require B.S or the equivalent in Comp.Sci, Math. Engr. MIS or in a closely related field. Competitive salary. Full-time; Mon-Fri. Resume to Crawford Group, Inc. at spiatt @erac.com. No call/EOE.

divine, Inc., computer software applications developer and consultancy, has the following positions available: Consultants, Senior Consultants, Software Engineers Senior Software Engineers, Systems Engineers, Application Integration Engineers, Technical Training Specialists, Development Team Leads, Managers, Directors. Openings available in the following locations: Santa Monica, CA, Denver, CO, Fairfield, CT, Norcross, GA, Chicago, IL, Lisle, IL, Columbus, OH, St. Louis, MO, Burlington, MA. Permanent U.S. work authorization required. Applicants should authorization required. Applicants should indicate position and location you are applying for and forward resume to divine, Inc. Attn: DK 1, 333 Warrenville Rd., Lisle, IL 60532 or by fax addressed to DK 1 at: 630-799-0060. EOE.

Seeking qualified applicants for the following position in Memphis, TN: Senior Programmer Analysts: Formulate/define functional requirements and documentation based on accepted user criteria. Requirements: bachelor's degree or equivalent* in computer science, MIS, computer systems engineering or related field plus 5 years of experience in systems /applications development. Experience with client/server technology or object-oriented analysis; C, C++, Smalltalk, Visual Basic or Java; and CORBA also required. *Master's degree in appropriate field will offset 2 years of general experience. Submit resumes to Sibi George, FedEx Corporate Services, 1900 Summit Tower Blvd., Suite 1400, Orlando, FL 32810. EOE M/F/D/V.

Computers: System Project Directors needed: Plan, direct and coordinate systems project delivery; Lead team/s on complex systems projects; Provide guidance on troubleshooting technical issues to enhance system functions. Experience must include two years working with Mainframe, COBOL and ASP. Requires MS /BS degree or equivalent and/or relevant work experience. Mail resume, references and salary requirements to: Investor's Bank & Trust, 200 Clarendon Street, Boston, MA 02116.

Seeking qualified applicants for the following position in Memphis, TN: Senior Programmer Analyst. Formulate/define functional requirements and documentation based on accepted user criteria. Requirements: Bachelor's degree* in computer science, MIS, engineering or related field plus 5 years of experience in systems/applications development. Experience with UNIX Shell programming; C and/or C++; and SOL also required. *Master's degree in appropriate field will offset 2 years of general experience. Submit resumes to Sibi George, FedEx Corporate Services, 1900 Summit Tower Blvd., Suite 1400, Orlando, FL 32810. EOE M/F/D/V.

DATAWAREHOUSING CONSULTANT Analyze customer reqts, identify & implement solns. Participate in dvlp & pre-sales events. B.S. Info Systems, Comp Science or equiv + proficiency in Java, JSP, JavaScript, Servlets, Visual Basic. Competitive Salary. Send resume to: Solution Builders, 1000 Abernathy Rd, NE, #175, Atlanta, GA 30328

Computer
ARINC, a leading provider of communications, information technology, and system engineering, has an opening for a Staff Principal Engineer with Animator experience in our Marina del Rey, CA office. The individual will be responsible for working as a chief architect of graphical interface, networking and Java. Specifically, the individual will lead efforts, which utilize the Animator product. Requires a minimum of five years of experience in the job duties offered. Must have technical and working knowledge of Animator, as well as programming experience in Java, C++, C, Windows NT/2000, and UNIX operating systems. Visit us online to apply at: www.arinc.com/careers. Please refer to this ad when applying. Equal Opportunity Employer M/F/D/V.

CSI (Comprehensive systems, Inc.) is looking for IT professionals (Programmer/System Analyst, DBA, Software/Project Engineers, OA. Candidates must have BS plus 1-yr exp. Skills in CICS, COBOL, DB2, HTML, VBScript, Java, Websphere preferred. Apply to hr@csicos.com. EOE.

Software Engineers wanted by 7 Hills Tech to perform: design, develop & implement client/server & web-based applications. Qualified applicants must have BS. Exp. using OOA/OOD in Java, J2EE, Oracle required. Send resumes to employ@7hillstech.com. EOE.

PeopleSoft Administrator and/or Oracle DBA - Radio Free Europe /Radio Liberty, located in beautiful Prague, Czech Republic, is seeking an Applications Development Specialist. Primary responsibilities will be to support Human Resource and Financial operations. Hands on Oracle DBA or Peoplesoft skills are a must. Good pay and benefits, interesting company. Intrigued? Look at www.rferl.org/welcome/english/jobs/EOE M/F/D/V

Sr. Billing Software Eng. Analyze, design, code usage record collection of interfaces b/w telephony switching equipment & existing NT-based BCC software product. 3+ years in development VC++ /MFC database applications, SQL Server preferred. Extensive knowledge of cellular, GSM /PCS, wireline and CIBER/TAP, as well as switch/tape interfaces. 9-5 40hrs/wk 85K Rancho Cucamonga, CA. send cv hr@arisinc.com. 888.274.3995

◆

SBI is looking for the following positions for its offices in Houston, TX, San Francisco, CA, Warren, NJ, Salt Lake City, UT and Portland, OR: Programmer Analysts, Technical Architects, Technical Consultants, Business Strategists, Systems Analysts, Software Engineers. resumes by email or fax only to HR, SBI 2825 East Cottonwood Parkway, Suite 480, Salt Lake City, UT 84121: careers@sbiandcompany.com; Fax (801) 733-3201.

Programmer Analyst for Natick, MA office to plan, develop, test and document computer programs, to analyze, review and alter program to increase operating efficiency or adapt new technologies. Full time position M-F offers good salary. Applicants with 4 yrs experience & working knowledge of Oracle, SIS/Compass, SPF, Lotus notes, Micro focus Animator, PVCS, Unix and SOL, Developer/2000/6 and COBOL, send resumes only to Mario Cabrera, Human Resources, FDP Corporation d/b/a Sun Gard Insurance Systems 2000 S Dixie Hway Miami FL 33133.

Programmer/Analyst (Jacksonville, FL): Design and develop software on Java, VB, JSP using Oracle, CORBA with Visibroker / Orbix, Java Socket Programming, Weblogic, Websphere and JBoss Server w/ Tomcat, iPlanet, JRun, etc. Req. B.Sc. or its foreign degree equivalent based on education and/or experience in C. Sc. Maths. or other science field + 2 yrs. exp. in job described. Resume to: HR Manager, Software Services & Resources, Inc., 3574 Old Milton Pkwy, Alpharetta, GA 30005

Senior Principal Engineer - CCBS; Dulles, Virginia: Provide technical customer support for US & international users of the five instances of the Customer Care & Billing System (CCBS) & its interfaces to the relevant mediation devices & switches. Analyze & determine which system, database, business process or interface has caused the problem & provide solutions. Create scripts to fix or monitor the databases. Provide guidance & recommendations regarding business practice modifications. Work with switch & mediation device engineers & technical users world-wide to test & implement CCBS. Apply knowledge of Oracle and UNIX systems, GUI, switch & mediation device databases & all of the business processes of the billing, invoicing and provisioning systems. Bachelor's degree or equivalent in Electrical Engineering or a closely related field.& 6 yrs exp. in the position offered or in a systems engineering position two yrs of which must have been in the telecommunications industry. 6 yrs exp. must include at least two yrs exp with switch protocols, mediation devices, oracle databases, telecom products & billing systems & billing product development. 40 hrs per wk, domestic & int'l travel required (25%). Send resume to Carrie Carr-Main, ORBCOMM, 21810, Atlantic Boulevard, Dulles, VA 20166

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Lionbridge Technologies Inc. has two openings in its Framingham, MA office for Software Development Engineers who have a Bachelor's degree or equivalent in Computer Science, Systems Engineering or a related field and 2 years of experience programming in Java using UML design techniques on Windows and Unix, 2 years of RDBMS experience with Oracle and MS SOL, 1 year of experience in Internationalization, and experience with complete development lifecycle. (Experience can be concurrent). Interested candidates should send resume to Ref. SLTL-BP, Maria Lopes, Human Resource Manager, Lionbridge Technologies, Inc., 492 Old Connecticut Path, Framingham, MA 01701.

VegaStream, Inc., located in Dublin is seeking F/T expd. Manager of Product Support to research, design, and developing of computer software systems, in conjunction with hardware product development. Analyze software requirements to determine feasibility of design within time and cost constraints. Consult with hardware engineers and other engineering staff to evaluate interface between hardware and software, and operational and performance requirements of overall system. Formulate and design software system, using scientific analysis and mathematical models to predict and measure outcome and consequences of design. Bachelor's degree in Computer Science, competitive salary. Fax resume to Gina (561) 995-6027.

Syst Analyst (Oakbrook, IL) Analyze user req'ments, develop project process flow, program specifications, develop tests & conversion plans, consult & advise tech personnel on applic procedures, plan & prep tech reports, memoranda. MS in Comp Sci/Comp Applic/Eng & 1 yr exp w/Unix, C, informix. $69,000/yr, 40 hrs/wk, 9a-5p. Applicts must show proof of legal authority to work in US. Res to IL Dept of Empl Security, 401 South State St -7 North, Chicago, IL 60605. Attn: L. Jackson, Ref # V-IL 26357-J. An employer paid ad. NO CALLS * Send 2 copies of both res & cvr ltr.

Computer Support Specialist: For provider of IT& systems, provide tech assistance to programmers; customize, train, support users of accounting apps, MS office; hardware & network setup & support; web design. Req's: M.S. in Comp Sci or related field. 1 yr exp in job offered or 1 yr exp as Software Eng. Exp must incl software dev, network & database dev & software installation & troubleshooting & user support. Prof in MS Office, MS Visual Basic, Sybase, Oracle & MS Access. 40 hrs/wk. Send resume to Terry Bauman, 1323 Little Mountain Rd., Bethel, PA 19507.

Sr S/W Engineers Lead teams to design/develop s/w appls using SAP, ABAP/4, VB, Oracle, Dev 2000 and Windows; integrate computer-aided scheduling, dispatch, outage mgmt, work planning etc; conduct data conversions, archiving, customization while administering SAP systems; gather/document reqs; train team & clients. Require MS in CS/Math/ Engg(any branch) & 3 yrs exp. Will also accept BS or foreign equiv in any of above & 5 yrs of relevant progressive exp. Travel involved. High salary f/t. Resumes to HR, Smartsoft International 4898 South Old Peachtree Road, Suite 200, Norcross, GA 30071

PDM ("Product Data Management") Implementation Consultant, working under the close supervision and continued monitoring of the Group Leader, will perform technical and consulting activities including PDM ("Product Data Management") system design and implementation. Will assist in facilitating customers' implementation activities in the area of foundation building, customer education and education planning, and project planning and execution. Will execute product implantation tasks, project level implementation strategies, and participate in program activities. Will also aid in user learning curve compression, mentor implementation associations, and document methodologies and case studies. Requires Bachelor's Degree in Computer Science, Mechanical Engineering, MIS, Electrical Engineering, Physics, Math or the equivalent, and one year of experience in Job Offered or one year of experience in PDM consulting or PDM development, OR, in the alternative, a Master's degree and zero (0) year's experience. Salary: $64,207/yr; 40 hrs/wk; M-F 9:00a.m.-5:00p.m. Job in Lisle, IL. Applicants must show proof legal authority to work in the U.S. Submit resume to: ILLINOIS DEPARTMENT OF EMPLOYMENT SECURITY, 401 South State- 7 North, Chicago, Illinois 60605, Attention: Joanne Breaux, Reference # V-IL 33262-N AN EMPLOYER PAID AD. NO CALLS SEND 2 COPIES OF BOTH RESUME & COVER LETTER.

Network Engineer. 40 hrs/wk. 9:00 a.m. - 5:00 p.m. Bloomington, IL. Install, configure and trouble shoot computer systems networks. Provide installation, service and support of Netware, NT and Exchange servers and installation of CISCO switches. Required: 2 yrs exp in job offered, as systems engineer, or related (exp must include 2 yrs providing installation, service and support of Netware, NT and Exchange servers and installation of CISCO switches); Certification as CISCO Certified Network Professional (CCNP); and Certification as CISCO Certified Internetwork Expert. NO PHONE CALLS. Resumes to: Logical Networks, Inc., Kim Slappy, 1750 South Telegraph Road, #300, Bloomfield Hills, MI 48302.

Synergy has openings for IT professionals or engineers. Qualified applicants must have BS/MS with 1-year experience. Strong background in TCP/IP Suite, Unix, DB2, Oracle, VB, SOL, IIS, Window NT and XML is plus. Send resumes to hr@synergycom.com. Travel is required. EOE

OA Engineer/Analyst/IT professionals wanted by E-Comlogics. Work in Pittsburgh, PA. Minimum requirement is BS in comp science or engg. plus 1-yr OA exp. using automation tools/script. We are small, but very stable. Please apply at resume@ecomlogics.org. EOE

ExlmWare, a s/w & service company for global agriculture trade markets, is looking for Business /System Analysts & S/W Engineers. Min. BS with 1-yr related exp. required. Key skills: s/w design, dev. and testing, proj mgt., OO prog., java, and xml. Send resumes to: careers@eximware.com.

Anacon has openings for IT professionals (software engineers, programmer/system analysts). Candidate must have BS/MS. One-year exp. is a minimum. Skills in areas of C, COBOL, Oracle, SOL, Sybase, DB2, PeopleSoft, SOA, VB are plus. Contact anacon@anacon.com. EOE.

Software Engineer, Merrimack. Research, design & dev. comp softw. systems, in conjunction w/ hardware product devpnt. Consult w/ hardware eng'rs and other eng staff to evaluate interface betw hardware & soft., operational & performance req"s of overall system. Provide tech. guidance on client projects. Will use Solaris, Unix, Linux, windows 2000 server, NT, Java, Perl, AWK, Cobol, C, C++, Visual C++, Borland C++, Oracle Dev 2000, Oracle Reports, Crystal Reports, Clear Ouest, Rational Clear Case, Rational Robot, VB, ASP, SQL, Oracle, MS Access, XML, HTML, UML, Javascript, VB Sript, Shell Script, COM, COM+, DCOM etc. Will accept Bach"s in CS, Eng, MIS, Math + 5yrs of exp as prog anal/syst anal. Or Mast"s + 2yrs exp as a prog anal/syst anal. Req. $ 85,000/hr, 40hrs/wk, 9:00am to 5:00pm. Pls. send 2 copies of resume/letters of application to: Job Order # 2002-328, PO Box 989, Concord, NH 03302-0989

SOFTWARE ENGINEER: Knowledge of IBM AS/400 midrange systems and Honeywell Bull mainframe systems on which key business systems are based. Knowledge in both VB6 Enterprise development software and Interdev Web development software to design client front ends. Knowledge in Oracle database technology. Job duties are to Analysis of current procedures and problems to refine and convert the data to programmable form; determine output requirements; study existing systems to evaluate effectiveness; upgrade systems presently in use; develop test and implement new software; observe functioning of newly implemented system and programs for trouble areas; correct systems/programs as necessary. Requires High School in sciences with 4 years of software development experience. 40 hours per week at $ 60,000 per year. Please send resume to Case # 200111215, Labor Exchange Office, 19 Staniford St., 1st floor, Boston, MA 02114.

Software Engineer, Merrimack. Research, design & dev. comp softw. systems, in conjunction with hardware product devpnt. Consult with hardware eng'rs & other eng staff to evaluate interface betw hardware & soft., operational & performance req's overall system. Provide tech. guidance on client projects. Will use Solaris, Unix, Linux, windows 2000 server, NT, Java, C, C++, Visual C++, Oracle, HTML, Java Script, Vb Script, Shell Script, MS SQL Server, ASP, Clear Ouest, Clear Case, Informix. Bach's in CS, Math or MIS plus 5yrs as systems analyst /prog analyst, Will accept Mast's + 2yrs exp as a prog anal/syst anal. Req. $ 85,000/hr, 40hrs/wk, 9:00am to 5:00pm. Pls. Send 2 copies of resume/letters of application to: Job Order # 2002-329, PO Box 989, Concord, NH 03302-0989

Software Developer
Design customized software solutions based on a client's needs. Must have Bachelors Degree in Engineering or Computer Science or in a related field & 18 months exp. or 18 months exp. in a related position w/ability to use: SOL & AS/400.
Willing to travel and relocate across the U.S.

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Attn: K. Markandan

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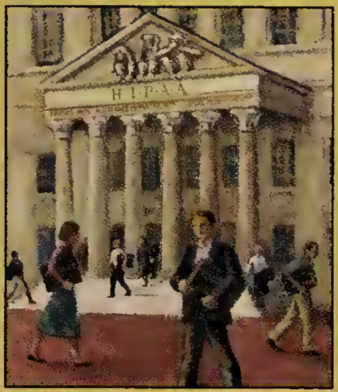

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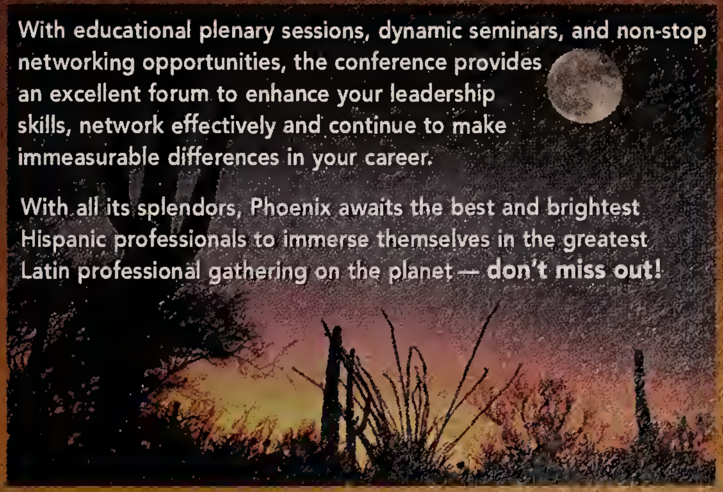

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SENIOR SOFTWARE ENGINEER to develop prototypes of computer systems using modeling and simulation tools including MATLAB, SIMULINK and C++; Design and implement middleware COM components using VC++, SOL, ADO, MTS and MSMO, design and implement front end GUI using Crystal Reports, ASP, JavaScript and XML, develop back end databases using DB2, and implement multi dimensional data cubes using MS OLAP analysis services for online analytical processing of energy data; Design and develop VSAM data access method services to interconnect COM middle tier with IBM mainframe platform using JCL and DB2; Develop shrink wrapped installable products using Install Shield. Require: B.S. degree in Computer Science, an Engineering discipline, or a closely related field with five years of progressively responsible experience in the job offered or as a Systems Analyst. Competitive salary offered. Apply by resume to: Frank Beaman, Global Software Development Services, Inc., 10 South Fifth St., Suite 600, Minneapolis, MN 55402; Attn: Job VG.

Software Engineer to Design, Develop and Engineer distributed applications using Vignette V6, ATGDynamo,Weblogic,WebSphere,Topiink 4.6, JAM, JADE, SOAP, DB2 and Javlin 1.2. Utilize SS7,IS41,X.25,CORBA,VisiBroker,Orbix,Xalan,Xerces,Together J,RUP,VisualAge5.0(xlC) on AIX 5L.Bachelors Degree in Engineering and five years exp or Masters Degree and Three years experience or equivalent. Send resume to ACS International Resources, Inc. Attn: Dir. Operations. 5 Innovation Way. Newark, DE 19711

COMPUTER

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Business Development Manager
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Business Development Consultant
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Business System Analyst
(BS in CS/Eng./Mgt + 2 yrs exp.)

Project Lead
(MS in CS/Math/Eng. + 3 yrs exp. or BS + 5 yrs exp.)

Senior System Analyst
(MS in CS/Math/Eng. or BS + 3 yrs exp.)

Programmer or System Analyst
(BS in CS/Math/Eng.)

Mail resumes to: HR, INFY 34760 Campus Dr., Fremont, CA 94555 or email: careers_usa@infosys.com.

www.infosys.com

Oracle Database Administrators needed: Seeking qualified candidates possessing; MS/BS degree or equiv. and/or rel. work exp. Rel. work exp. must include 1 yr of exp. with load balancing between OPS clustered servers. Maintain, monitor and troubleshoot databases; Plan and implement disaster recovery operations. Work with the following: Oracle version 9i, HP Unix Admin., As/400, Oracle Financial Sys. Mail resumes , trans., ref. and salary to: American Arbitration Association, 335 Madison Ave., New York, NY 10017-4605 EOE. M/F/H.

Development Systems Analyst. Job location: Dallas, Texas. Duties: Deploy & integrate enterprise applications in the areas of sales, marketing & customer service using Siebel eBusiness architecture & applications. Involved with leading customizations in customer tracking systems in Siebel eBusiness Applications. Research architectural issues within existing applications, & architect & design code enhancements. Perform hands-on coding on client/server architecture with MS Visual Basic/MS SOL & IBM DB2, Unix (AIX), HTML, XML, Siebel Systems configuration, Workflow Manager, Assignment Manager, EIM, EAI, CTI, Actuate Reporting using Siebel Tools, Siebel Smart Scripting, & Product Configuration. Configure/modify/support Siebel versions 99, 6.2.2 & 7.0.4. Carry out direct Siebel interfacing via CTI to Genesys & Rockwell Switches. Understand end user business needs & ensure they are met in software delivery (GAP Analysis, Design Documents & Proposed Business Process Flows). Requires: Master's degree/foreign equiv. in Comp. Science/Comp. Eng./closely related field. In lieu of Master's degree/foreign equiv., will accept Bachelor's degree /foreign equiv. plus five years' progressive exp. Must have 3 years' exp. in job offered or 3 years' exp. as a Consultant. Exp., which may have been obtained concurrently, must incl.: at least 2 yrs.' exp. with client/server architecture, MS SOL & IBM DB2, & Siebel eBusiness architecture & applications, incl. Siebel Systems configuration, Workflow Manager, Assignment Manager, EIM, EAI, CTI, Siebel Smart Scripting, Product Configuration and Actuate Reporting using Siebel Tools, & Siebel versions 99, 6.2.2 and 7.0.4 ; and at least 2 yrs.' exp. producing GAP Analysis, Design Documents & Proposed Business Process Flows. Must be Siebel eBusiness Consultant - Certified. EOE. 40 hrs./wk. Send resume (no calls) to Jolie Wiese Short, Manager, Corporate Staffing, CompUSA Inc., 14951 North Dallas Parkway, Dallas, Texas 75254.

PROGRAMMER/ANALYST to analyze, design, develop, test, implement and maintain multi-tier client-server and web-based application software for the accounting industry using UML, COM/DCOM, MTS, Visual C++, Visual Basic, ASP, VB Script, Java Script, Visual Interdev, ActiveX Components, DTS, WinSockets, IIS with SQL Server, Oracle and MS Access under Windows NT/2000 operating systems. Require: B.S. degree in Computer Science, an Engineering discipline, or a closely related field with two years of experience in the job offered or as a Programmer. Extensive travel on assignments to various client sites within the U.S. is required. Competitive salary offered. Send resume to: Srinath Duddilla, President, SunPlus Data Group, Inc., 3783 Presidential Parkway, Suite 130, Atlanta, GA 30340; Attn: Job ND.

SENIOR SOFTWARE ENGINEER to lead a team in the design, development, implementation and maintenance of Internet based application software using C, SOL, PL/SOL, Pro*C, Oracle, Teradata, HTML, Perl, Java and Java Script under Windows NT and UNIX operating systems; Supervise and mentor junior programmers and engineers. Require: Bachelor's degree in Computer Science, an Engineering discipline, or a closely related field with five years of progressively responsible experience in the job offered or as a Programmer /Analyst, or Programmer. Extensive travel on assignment to various client sites within the U.S. is required. Competitive salary offered. Apply by resume to: Rajender Gaddam, Orpine Enterprises, LLC, 1004 Crooked Creek Court, Mableton, GA 30126; Attn: Job AB.

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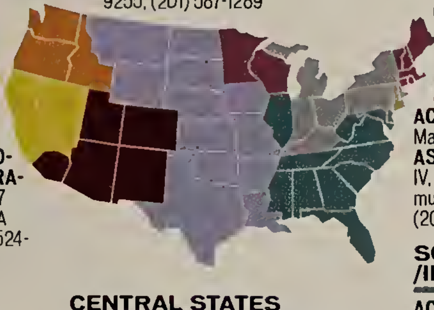

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State Privacy Actions May Spur Congress

Compliance with disparate laws a concern

BY PATRICK THIBODEAU
WASHINGTON

PRIVACY, THE leading technology issue in Congress before last year's terrorist attacks, has taken a back seat to homeland security, corporate financial scandals and Iraq. But as Washington has cooled to the issue, some states have taken some aggressive actions — and that may spur federal lawmakers to preempt the ability of states to adopt their own privacy rules.

According to the National Business Coalition on E-Commerce and Privacy, a Washington-based group that represents large financial services firms and retailers, 548 privacy bills have been introduced in state legislatures this year. Some have already been enacted: San Mateo County in California recently set restrictions on data sharing and is now facing a court battle with the state's large banks, and North Dakota residents recently voted for such restrictions as well.

Minnesota, meanwhile, restricted what Internet service providers can do with customer data and information regarding Web browsing habits. Service providers that share data to customize advertising may be violating the law.

"The Minnesota model is the one that scares the industry the most," said John Palafoutas, a senior vice president of the AEA, a Washington-based high-tech trade association, who warned a congressional committee last week that Minnesota's law will be used as a template by other states.

Senate vs. House

Key differences between the two leading privacy bills:

OFF-LINE VS. ONLINE

- Privacy rules in the House bill cover online and off-line transactions; the Senate bill is online-only.

SPECIAL DATA GROUPS

- The Senate bill distinguishes between sensitive and nonsensitive data, the House bill does not.

OPT-IN VS. OPT-OUT

- The Senate bill includes an opt-in provision for certain kinds of personal data.

This push by states, coupled with fears that companies may have to spend millions of dollars to ensure that systems comply with data-handling rules that vary by state, has softened opposition to privacy rules.

Amazon.com Inc. continues to oppose privacy legislation and argues that it "might mislead some observers into thinking . . . a bill is necessary to improve consumer confidence," said Paul Misener, Amazon's vice president of global public policy at a hearing last week. Nonetheless, the online retailer could support the leading House bill to prevent a "crazy quilt of state consumer privacy legislation," he said.

Getting a Privacy Footing

There are two major privacy bills that would preempt state measures: a House bill sponsored by Clifford Stearns (R-Fla.), who heads the Commerce, Trade and Consumer Protection subcommittee, and a competing bill in the Senate, authored by Ernest "Fritz" Hollings (D-S.C.). Neither bill is expected to win approval before Congress adjourns next month. But "a lot of the developments this session will be the launching point for what happens next session," said Stuart Ingis, a privacy expert and an attorney at Piper Rudnick LLP in Washington.

Stearns, following a hearing last week on his bill, the Consumer Privacy Protection Act, said that state actions are going to give much more impetus to a federal privacy bill and he is hoping to see committee action.

The moves by states also reflect a broad desire for stronger rules, said Marc Rotenberg, executive director of the Electronic Privacy Information Center in Washington. He said state and county actions on privacy show "how strongly people feel about this issue."

Jon Schall, executive director of the National Business Coalition, said Stearns' bill "lays out a clear-cut and balanced privacy policy."

Schall also praised the bill for what it wouldn't provide: a requirement to give consumers access to the personal information that companies hold on them, which could lead to centralized systems.

"Access provisions are best avoided because they could ironically create perverse incentives for companies to centrally maintain exactly the sort of customer profiles that we all seek to avoid," he said. ◗

PRIVACY STORM BREWING

The impending expiration of a provision of the Fair Credit Reporting Act has some industries worried:
QuickLink 33191

One leading privacy bill would impose broad security requirements on companies:
QuickLink 33189
www.computerworld.com

Continued from page 1

Privacy System

The privacy manager is intended to address the problem of applying customer privacy preferences, legal requirements and company policies to business practices throughout a corporation. Many systems that do that today are limited to specific applications.

This IBM system, however, uses a privacy classification protocol, the World Wide Web Consortium's Platform for Privacy Preferences (P3P), to classify data on back-end systems. P3P allows privacy preferences to be turned into machine-readable code and is widely used in setting privacy policies for Web browsers. Once data is classified or tagged, servers or privacy monitors apply the P3P-enabled rules, enforce access rules and create audit trails.

To find out what customers needed, last November IBM pulled together 20 users from government and business to form the privacy council.

Privacy Management

Tivoli Privacy Manager is a Java-based system for managing privacy in back-end systems:

- **A P3P interface creates machine-readable privacy policies.**
- **The privacy manager links privacy policies to personal information.**
- **A reporting function shows enforcement and audits.**

By reaching out to end users, IBM "is able to get a more real-world view in terms of how whatever technology they develop can be effective in helping their customers deal with the privacy issue," said Chris Zoladz, vice president of information protection at Marriott International Inc. in Bethesda, Md.

Along with Marriott and Travelers, other privacy council members include Fidelity Investments in Boston, the U.S. Department of Commerce and Novant Health in Winston-Salem, N.C.

Implementing Tivoli Privacy Manager is no easy task. It was developed to work right out of the box with Lightweight Directory Access Protocol support, but Travelers, for instance, wants to use it with MQSeries, IBM's messaging platform.

Lacafta said the IBM system has to be instructed to handle a company's technology choices and noted that "it's not ubiquitous." But an idea he may raise with the privacy council is having the participants share their systems development work.

IBM is helping Travelers, and Phil Fritz, an IBM manager involved in the project, said development shouldn't be too difficult with the use of the privacy manager development kit. Regardless, IBM says that due to the customized nature of many end-user systems, the privacy manager will have to be adapted to work with those systems. And company officials don't expect the functions performed by the monitoring servers to hurt systemwide performance.

With privacy regulation on the rise, analysts and end users said corporations need to get better control of customer data — specifically, who sees it and who can use it.

Pete Lindstrom, an analyst at Hurwitz Group Inc. in Framingham, Mass., said that while IBM has a "unique approach overall" to privacy management, he expects other vendors to follow suit. "It's hard to believe that there aren't other folks out there" working on similar products, he said. ◗

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35 Years of Tech Flops

THE PAST 35 YEARS are littered with the remains of technology failures and flops, losers and bad ideas. That's the Darwinian nature of the IT business: Dozens or hundreds of people, companies, products and ideas compete and only a handful emerge as winners. The rest? They're losers. Failures. Flops.

A harsh assessment? Sure. Some were important in their time. Some changed the shape and direction of the IT industry.

In a fairer, kinder world, we'd maintain monuments to these icons of IT. Instead, we bulldoze the monuments, grind them into gravel and use them to pave the road to the future.

There are far too many even to mention them all. But here's a sampling:

First came the big-iron makers who went head-to-head with IBM and lost: General Electric, RCA, Honeywell, Control Data, Wang and Amdahl. Burroughs and Sperry Rand survived by merging in 1986 to form Unisys. NCR was swallowed by AT&T in 1991, then re-emerged from the belly of the whale in 1996.

Then the first spunky desktop computer makers in the 1970s: MITS, IMSAI, Cromemco, Godbout, Processor Technology, Exidy and NorthStar. They would have been the dot-coms of their day, except they were steamrollered by the well-capitalized Apple, Commodore and RadioShack.

And the heavyweights of the Great Home Computer Scare of the early 1980s, forced out by the IBM PC: Atari, Texas Instruments, Timex, Coleco, Mattel, Commodore and RadioShack. That's right — the big winners in one round got KO'd in the next.

Magnetic core memory, that huge advance over tubes, was overcome in a few short years by dynamic RAM. The first real portable computer, the Osborne I, was torpedoed by the cheaper Kaypro, which in turn was stomped by the PC-compatible Compaq luggable — and they all disappeared with the arrival of the laptop.

Digital Research's CP/M, the dominant desktop computer operating system before the IBM PC, was washed away by Microsoft's MS-DOS. The Electric Pencil word processor was trampled by WordStar, which was crushed by WordPerfect, which was demolished by Word. VisiCalc, the original Apple II spreadsheet, lost to Lotus 1-2-3 on the PC, which later fell to Excel on Windows.

There were vendors that didn't get it: AT&T couldn't figure out how to market Unix. Xerox couldn't make real money on graphical user interfaces and Ethernet networking. Hewlett-Packard rejected the original Apple computer.

There were first-movers that didn't move: Apple's Newton handheld. Grid's GridPad tablet computer. Hitachi's three-inch floppy disk — close, but no cigar. Apple's Lisa. And the first desktop microcomputer, the Kenback-1.

And leaders who lost their companies: Digital Equipment's Ken Olsen, Compaq's Rod Canion, Novell's Ray Noorda, Control Data's William Norris — and Apple's Steve Jobs, the only one who lost it and got it back.

Strategies that flopped: Microsoft's mid-1990s efforts to ignore the Internet. IBM's late-1980s try at stuffing the genie of PC clones back in the bottle with its Micro Channel Architecture. The U.S. government's attempt to standardize its software with the Unix-like Posix specification. Next Software's plan to let only universities buy its heavily hyped workstations. Profit-free dot-coms. Copy-protection dongles. Push technology. Competing but incompatible 56K bit/sec. modems. The NetPC.

There were relationships that just failed to jell: Novell and WordPerfect. OS/2 and Microsoft. Bill Gates and videotaped depositions.

And teeth-grindingly misconceived products that should never have seen the light of day: Dogmatic, inflexible computer-assisted software engineering methodologies. The IBM PC Jr. Microsoft's Bob.

If you're a little depressed after reading this litany of losers — well, don't be. That's how the IT business works. And there are plenty more failures, flops and losers where those came from. ◗

FRANK HAYES, *Computerworld*'s senior news columnist, has covered IT for more than 20 years. Contact him at frank_hayes@computerworld.com.

THE BEST AND THE WORST

THE TOP 10 RICHEST AMERICANS

1. William H. Gates III
2. Warren Edward Buffett
3. Paul Gardner Allen
4. Helen R. Walton
5. S. Robson Walton
6. John T. Walton
7. Jim C. Walton
8. Alice L. Walton
9. Lawrence Joseph Ellison
10. Steven Anthony Ballmer

SOURCE: *FORBES* MAGAZINE, SEPTEMBER 2002

THE TOP 10 MOST ADMIRED SOFTWARE COMPANIES

1. Microsoft
2. PeopleSoft
3. Oracle
4. Computer Associates
5. Siebel Systems
6. Adobe Systems
7. Electronic Arts
8. Cadence Design Systems
9. Compuware
10. BMC Software

SOURCE: FORTUNE.COM, 2002

LONGEST-RUNNING ANTITRUST TRIALS

- IBM 13 years (1969 to 1982)
- U.S. Steel 9 years (1911 to 1920)
- AT&T 8 years (1974 to 1982)
- American Tobacco 5 years (1906 to 1911)
- Standard Oil 5 years (1906 to 1911)
- Microsoft 5 years (1997 to the present)

SOURCE: HOOVERS.COM

WHEN A PENCIL IS BEST

Some things haven't changed in 35 years. A pencil still beats a computer if you want to:

1. Fill in a crossword puzzle
2. Chew on something while you think
3. Doodle during meetings
4. Drum on your desk
5. Pop a balloon
6. Mark your kid's height on a doorjamb
7. Check off your grocery list at the market
8. Shoot rubber bands
9. Dial a rotary phone
10. Sketch an idea on a cocktail napkin

SOURCE: *COMPUTERWORLD* STAFF

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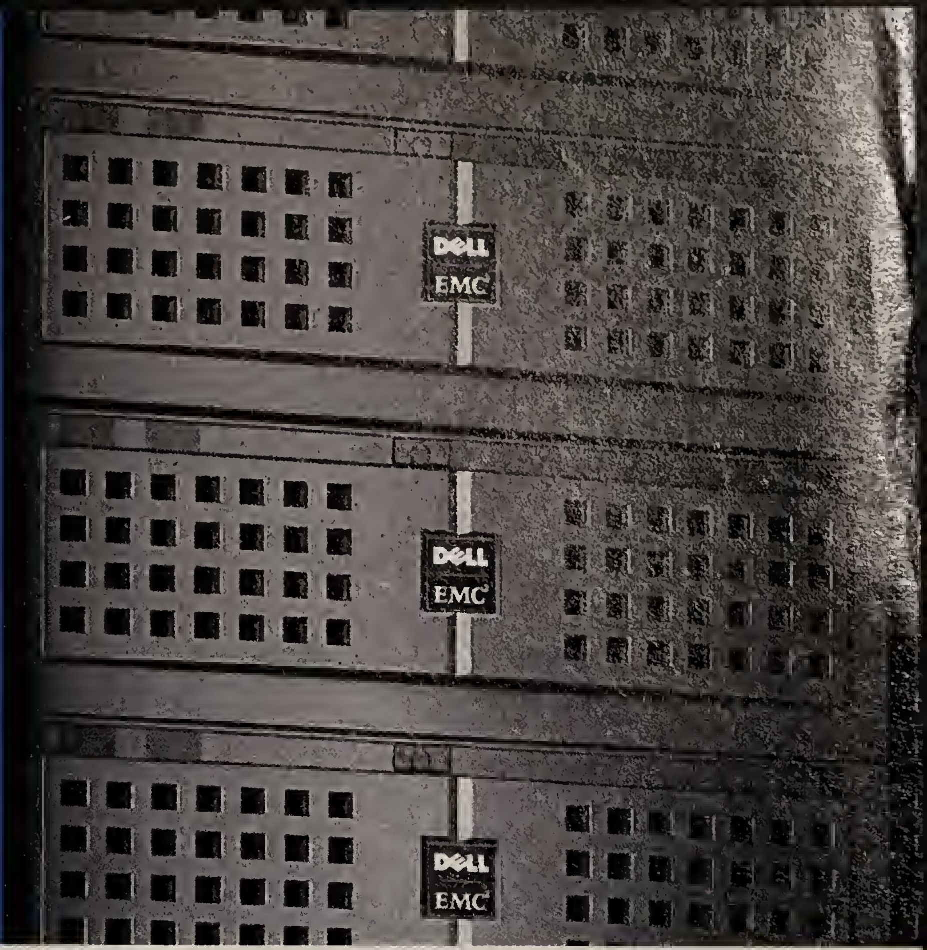

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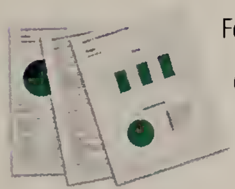

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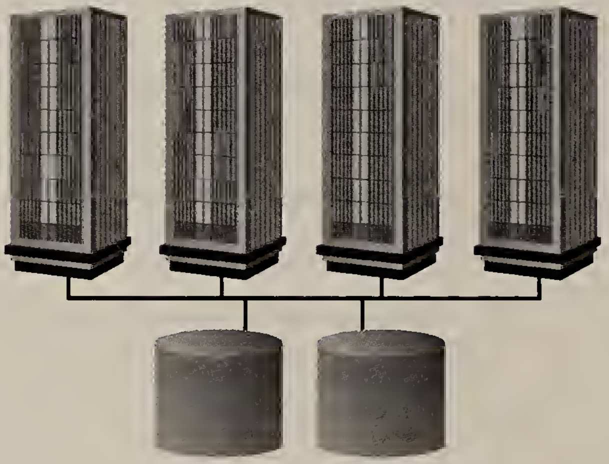
Unbreakable

Linux



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